SmartRob 2006 Blimp robot contest

Salle Polyvalente, EPFL

" Blimp Pylon Racing "

Flying robots

Version 1.3 (May 25th, 2006)

These rules will be kept unchanged as far as possible, but can be modified if necessary. In the case of modification of the rules, the participants will be notified by e-mail. The latest version of the rules can be found on the web (http://www.smartrob.org).
In the case of discussions about the rules and/or their application, the organizers will decide what to do, based on their opinion of what is closest to the spirit of the contest. The decision of the organizers cannot be discussed.

1. Theme of the contest

This year the robots will have to race around vertical pylons, in the style of the Reno aerial races. No obstacles, no penalties, just two blimps racing in loops on circuits around two luminous pylons high above the heads of the audience. Blimps will have to be fast and precise!

2. Contest environment

The environment is formed by 2 pylons hanging from the ceiling of the Salle Polyvalente at EPFL, as depicted in Figure 1.

The pylons are made of translucent fabric fitted with enough luminescent tubes so that they appear as bright spots with respect to the background (the room will be darkened). Their height is 3 meters and their diameter around 50 centimeters. They hang approximately 2 meters above the bottom of the pit of the arena used by the wheeled robots, at a distance of approximately 8 meters from each other. Pylons will be attached to the ceiling using ropes that extend axially upwards.

The floor of the arena will consist of a dark brown carpet and will be scattered with low obstacles (wheeled robots, walls for the wheeled robot contest, etc.), all typically lower than 50cm. The ground outside the wheeled robot arena is a dark hardwood floor.
Spectators will sit behind a metal barrier in close vicinity of the pylons.

The ceiling is not flat but a construction of metal cross beams more than 1m deep. Its large metal bars have trapped numerous blimps in previous contests.

The final lighting conditions will be decided by the organisers in accordance with the participants.

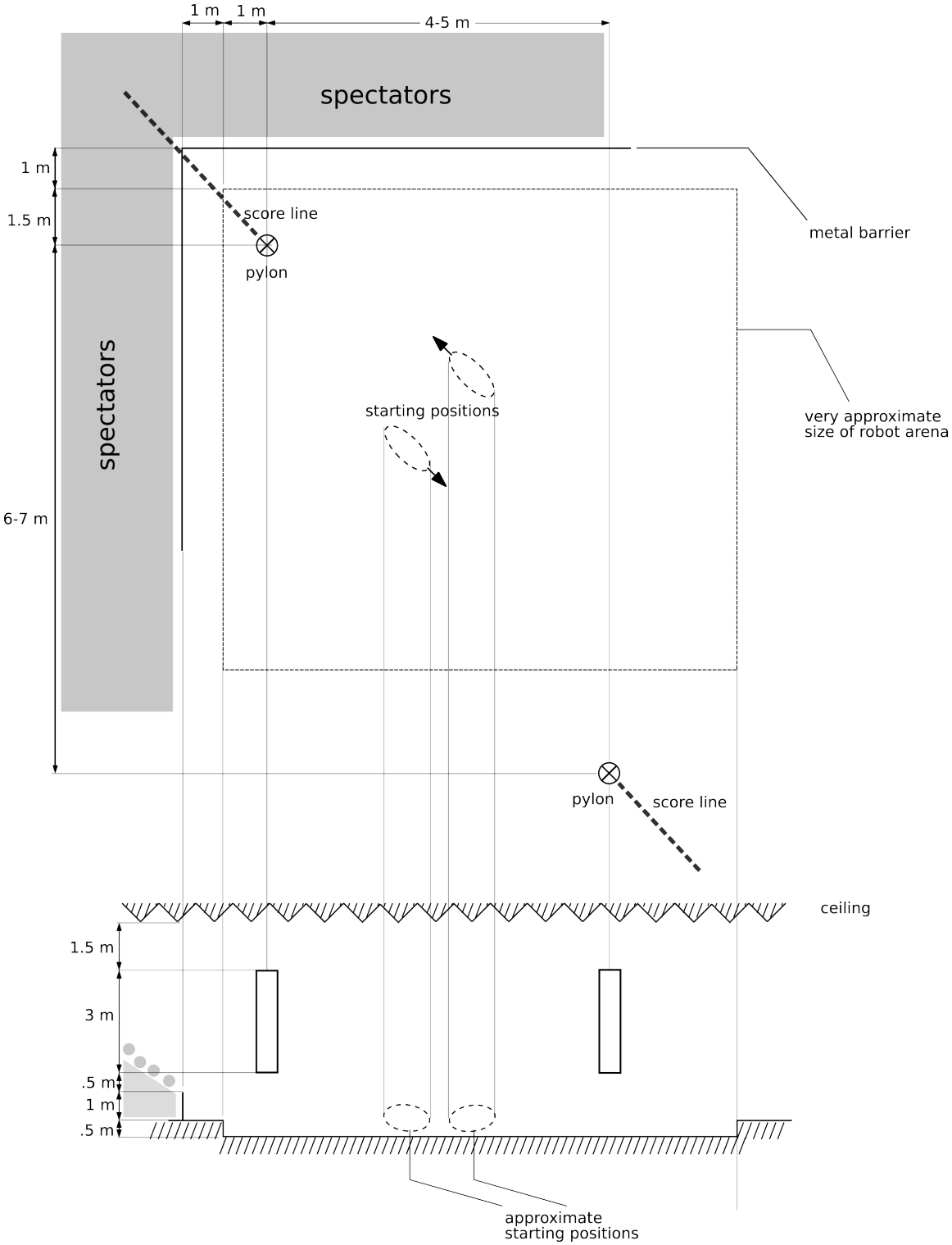

Figure 1: The blimp arena. All measurements are approximative.

3. Robots

Each team is given a kit containing at least the following hardware:

- 1 Mylar bag (to be filled with helium)
- 1 Li-Poly 360 mAh battery and charger
- 1 thruster (motor and gear box)
- 1 PIC18F6720 microcontroller board
- 1 TSL3301 camera module
- 1 Bluetooth module (for testing, qualification and monitoring purposes only)

This kit, with the exception of the bag, must be handed back after the contest, according to the organizers' instructions. In addition to the basic kit, teams will be awarded a virtual credit to select additional materials from an array of sensors and actuators from the LIS. A detailed list can be found on the website.

Each team must build its own robot using the kit and/or additional hardware, with the following restrictions:

- Only the provided bag can be used to create the lift (this defines approximately the size of the robot and the payload).
- The global volume of the robot must fit a box of 150×80×80 cm.
- No CPU or microcontroller more powerful than the one included in the kit is allowed.
- During the contest (not the qualifications), the robot must be completely autonomous, i.e. it carries its own energy source, sensors and actuators and relies exclusively on on-board processing power.

The structure of the robot (sensor and actuator placement, etc.) is otherwise left to the team's decision. It is also authorized to add additional sensors (accelerometers, other cameras, etc.), but these are not provided by the organizers. Positioning sensors that require external beacons are forbidden.

4. Qualification

In order to participate in the contest, teams will have to pass a qualification 3-4 weeks prior to the contest. Blimps must show autonomous altitude control while piloted manually around a pylon (using a joystick or keyboard and the Bluetooth connection).

The main purpose of the qualification is to verify the viability of the chosen concept. In addition, experience acquired while manually steering the blimp may be of great help in tuning the blimp's control regulators (due to their bulky envelope and light weight, blimps have very particular aerodynamical properties at higher speeds).

5. Contest

The contest will be held as a championship. Two teams will race against each other in large and/or small circuits around the pylons (see Figure 2). The blimp pairs competing will be chosen randomly the day of the contest.

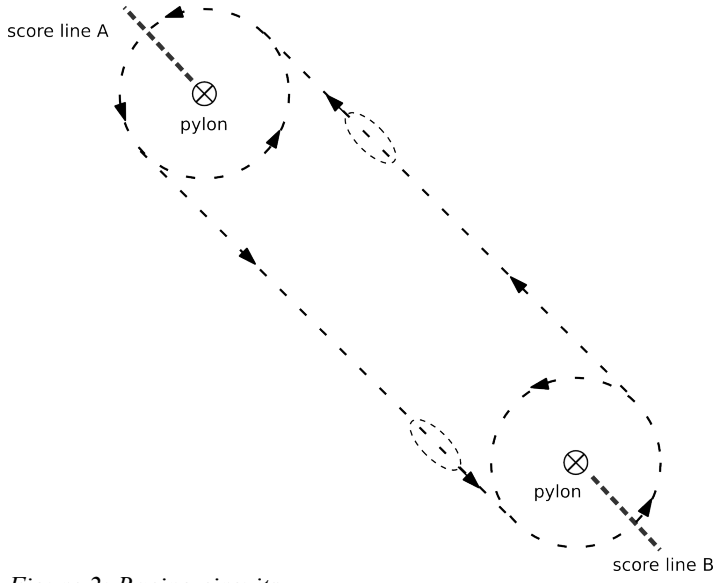

Figure 2: Racing circuits

Points are calculated according to the following rules:

- The team has 30 seconds to be ready with its robot floating a maximum of 30 cm above the starting position when called for a match. The starting positions will be designated by two markers on the arena floor (see Figure 2).
- Each match lasts either 3 minutes (preliminary matches) or 5 minutes (semi-final and final).
- Each half big tour flown by the blimp increases the H (half big tour) counter. Each small tour flown by the blimp increases the S (small tour) counter.
- Tours are defined using 2 score lines on the arena floor (see Figure 2). A half big tour (H) is defined as passing two different scorelines. A small tour (S) is defined as passing the same score line a second time after a complete turn around a pylon.
- The match points are calculated with this formula:

$$\text{Match points} = H^2 + S$$

- No penalty is applied when the robot hits the ground, the pylons, the public, or flies outside etc.
- If the robot gets lost, one team member may reposition the robot in its starting position without disturbing the other blimp. After an intervention, counting will resume once the robot has crossed the first score line. After two interventions the blimp will be withdrawn from the match.
- The winner of a match is decided on his/her respective score.

- The referee alone is responsible for the score calculation and his decision can't be appealed. If two teams have the same score, a jury will decide the winner of that match.

Example for a score calculation for a parcours ABAxAA:
The blimp starts and successfully crosses score line A (H=S=0), then completes half a big tour crossing score line B (S=0, H=1) and again half a big tour crossing score line A (S=0, H=2), but loses its heading and gets lost in the audience so it must be caught and repositioned (x) (S=0, H=2). After again rising in altitude, the robot crosses score line A (S=0, H=2) and, after completing a tour of the pylon, again traverses score line A (S=1, H=2) before time runs out. The total score of 4 + 1 = 5 points makes it the winner against its opponent.

Structure of Championship
Each of the four teams will be matched once against each other team in six 3-minute preliminary matches:
1. Team A vs. Team B
2. Team C vs. Team D
3. Team A vs. Team C
4. Team A vs. Team D
5. Team B vs. Team D
6. Team B vs. Team C

Teams will be drawn randomly the day of the contest. After these 6 matches, teams will be ranked by the number of matches won. In case of a draw, ranking will be established by points accumulated in the preliminary matches.
Teams in third and fourth place will compete in a 5-minute semi-final. The two best teams of the preliminary matches will compete in a 5-minute final.

The contest will take place June 1st 2006.

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