

# RoboCup Soccer Simulation 3D League

*Rules for the 2017 Competition in Nagoya, Japan (July 27<sup>th</sup> - July 30<sup>th</sup>)*

*Rules Based on RoboCup 2016 and 2015 – Leipzig and Hefei, Competition Rules*

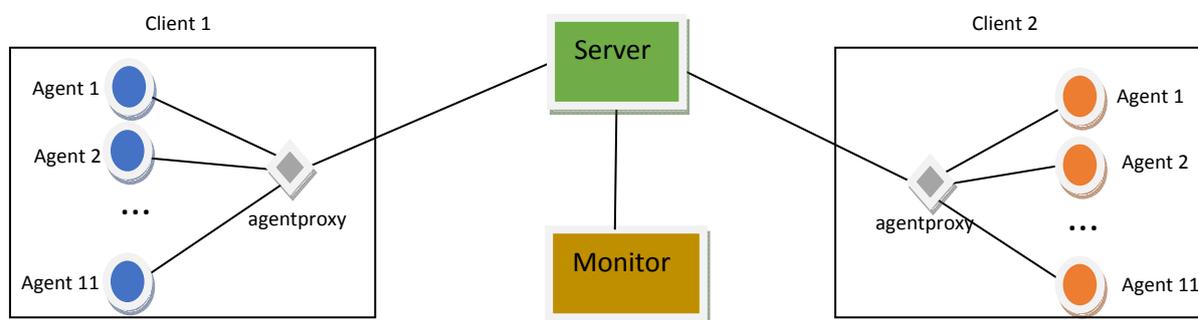
## 1 Organizing Committee

This document describes the rules that will be used at the RoboCup 2017 3D Simulation League. The goal is to provide for fair games and smooth execution of the competitions. The Organizing Committee (OC) has the right to append or change these rules at any time within reasonable bounds. All teams will be notified of these changes as soon as possible. Teams can appeal to these changes or to the rules in general, however the final binding decision will be made by the OC. The organizing committee for RoboCup 2017 simulation 3D league is composed by Tomoharu Nakashima ([tomoharu.nakashima@kis.osakafu-u.ac.jp](mailto:tomoharu.nakashima@kis.osakafu-u.ac.jp)) and Teruya Yamanishi ([yamanisi@fukui-ut.ac.jp](mailto:yamanisi@fukui-ut.ac.jp)).

## 2 Competitions and Schedule

### 2.1 Server and Server Changes

The competition will use Simspark 0.3.0 + Rcserver3D 0.7.1 (<https://hedayat.fedorapeople.org/misc/rcserver3d-0.7.1.tar.xz>) and Ubuntu 16.04 64 Bits. Oracle Java 8 Runtime (<http://www.webupd8.org/2012/09/install-oracle-java-8-in-ubuntu-via-ppa.html>) will be available for clients. Clients have to work with agentproxy 2.1 available at: <https://github.com/magmaOffenburg/magmaProxy> to connect to the server. The following figure shows how the software and hardware of competition environment is used. There are two client computers – one for each team – named client1 and client2; one server computer; and one monitor computer (robviz). All teams are strongly encouraged to test their code using a similar environment to avoid be penalized during competitions due to faulty agents. The OC will not install any additional libraries. So teams MUST manage to build their binaries including static links to all libraries they need.



### Changes 2017

- Crowding rules are not going to be used. It will be turned off during Round 0 (Seeding round) in RoboCup 2017 and let teams decide during the team meeting after this round if this change will be kept for following rounds.

- Hopefully fixed bug where double touches on kicks (kickoffs, free kicks, kick-ins, corner kicks) were not always being detected correctly -- there was an incorrect assumption about pointer memory addresses being equal that was allowing for this to happen. Also fixing an issue where if a player is touching the ball right when the wait time (1 second) at the beginning of a kick play mode ends (the time at which agents are beamed away from the ball) the play mode could end up recording the touch and inadvertently ending the kick.
- Fixing issue where if two players enter their own penalty area at the same time, and in doing so cause the maximum allowed number of players in the penalty area to be exceeded, both players will be called for illegal defense even if they're only one player over the allowed number of players in the penalty area. You can see an example of this if you place more than the allowed number of players in the penalty area before a game starts, and then at the beginning of a kickoff all players in the penalty area except for the goalie will be called for illegal defense.
- The automated referee will no longer move/reposition agents on top of each other (really bad and can cause server crashes) or into their own penalty area if it will trigger an illegal defense penalty. This is accomplished by doing a breadth first search around the position that an agent is to be repositioned to until a safe position is found. The breadth first search only considers positions that are at least as far as the distance from an agent's current position and the original position that the automated referee wants to move/reposition an agent to. For computational safety the number of positions that will be considered by the breadth first search is bounded by the `MaxNumSafeRepositionAttempts` value (default 100) in `naosocersim.rb`. Setting this value to 0 turns this feature off. If ever the server isn't able to safely reposition a player it will print an error message. To see what this looks like checkout the logs at <http://www.cs.utexas.edu/~AustinVilla/sim/3dsimulation/tmp/saferepositioning/> where a drop ball is performed in a cluster of players both with and without safe repositioning. The change purposely does not affect the repositioning of players when they request to be beamed or are moved by the training command parser (such as selecting and moving an agent with `roboviz`).
- The order in which players are evaluated for fouls and are penalized is now randomized so as to not have any bias associated with players' teams and uniform numbers. This change mainly only affects the above fixes for calling illegal defense and safely repositioning players.
- Fixed an issue where free kicks and kicks-in printed an error message and didn't behave correctly if the ball has yet to be touched by an agent. These are rare events, but can occur if a game is restored from a log file or if the play modes are manually initiated through the training command parser.

== Changes to the automated referee ==

- Changed averaging the velocity of an agent over the last 5 time steps to 3 time steps when determining fouls as averaging over greater numbers of time steps causes an agent to have less time to react and get their velocity down before potentially colliding with an opponent and being called for a foul. Note that the number of velocity measurements used as an average is adjustable by changing `AVERAGE_VELOCITY_MEASUREMENTS` in `soccerruleaspect.h`.
- Removing some code that takes into account the opponent's velocity moving away from a colliding agent when determining fouls -- this code was decreasing the

likelihood of an agent being called for a foul when running down an opponent from behind which I think is a particularly bad foul (possibly a red card in human soccer).

- Commented out the values for crowding rules in `naosoccersim.rb` and turned them off with a note that we hope to not use them for the 2017 competition. It's easy to uncomment the original values and turn them back on however.

Teams should refer to the complete information available at <http://sourceforge.net/projects/simspark/files/rcssserver3d> for the latest version changes and other information.

## Internet

A network hub with 6-8 ports of RJ45 type will be provided for each participant table. Please bring your own network cables to access the internet and the competition servers from your table. Please note that the network speed of the internet at the competition site is not very high and thus the participants are advised to moderately use the internet so that the organized committee are not prevented their work using the internet due to its heavy use by the participants. There is also free WiFi around the competition area which is open to public.

## 2.2 Competition Format and Challenges

### General Format and Schedule

The competition will include 4 rounds (seeding round, first, second and third round) followed by semifinals and finals. Teams not qualified in any round will play additional matches for full ranking. It will also include 3 challenges: Free/Scientific Challenge; Passing and Scoring Challenge and Gazebo Challenge. The tentative format and schedule is the following:

Tuesday: July 25<sup>th</sup>      Team set-up

Wednesday: July 26<sup>th</sup>      Team set-up  
Team Leaders Meeting (TLM) and Group Drawing (2pm-3pm)

Thursday: July 27<sup>th</sup>      Seeding Round – (9am) (*code upload deadline[Cud]: 8.30am*)  
TLM, TC Election and League Discussion (4pm-5:30 pm)  
Free/Scientific Challenge (6pm-7.30pm)

Friday: July 28<sup>th</sup>      First Round – (9am) (*Cud: 8.30am*)  
Passing and Scoring Challenge (5pm-6pm) (*Cud: 4.30pm*)  
Team Leaders Meeting (TLM) (6pm-7pm)

Saturday: July 29<sup>th</sup>      Second Round – (9am) (*Cud: 8.30am*)  
Third Round (3:00pm-4:30pm) (*Cud: 2:30pm*)  
9<sup>th</sup> to 16<sup>th</sup> places round(4:30-7:00pm) (*Cud: 4:00pm*)  
Gazebo Challenge (5:00pm-7:30pm) (*Cud: 4:30pm*)

Sunday: July 30<sup>th</sup>      5<sup>th</sup> to 8<sup>th</sup> places matches (9:00am-9:30am) *(Cud: 8:30am)*  
Semi Finals (10:15am-10:30am) *(Cud:08:30am)*  
3<sup>rd</sup> place match (12:15am-12:30am) *(Cud: 12:00am)*  
Finals (12:30am) *(Cud: 12:00am) (Finals time subject to other league finals)*

## Qualifying Rounds

For the seeding round and first round the teams will be split between two groups of equal or approximate size. For the second round two groups of 5 teams will be played. After the second round, all teams not qualified for third round will play a 9<sup>th</sup> to 15<sup>th</sup> places round. In third round, two groups of 4 teams will run a round robin and the 2 best teams from each group will qualify to semifinals. Each team in each group plays each other team of the group once in each round robin. In each round, placing will be determined in the following order:

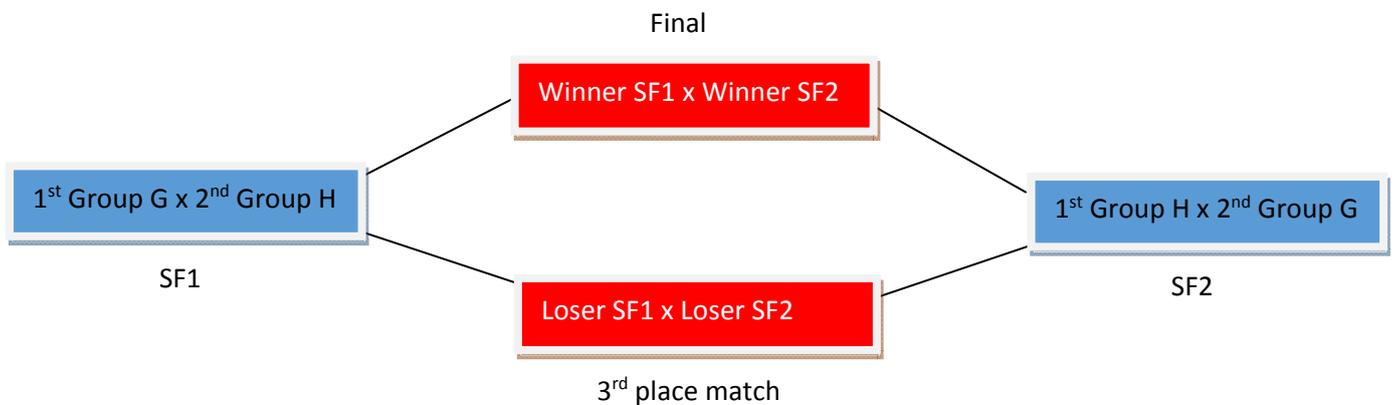
- Points gathered. A win gives 3 points, a tie 1 point and a loss 0 point.
- Goal difference (goals scored minus goals conceded) in this round.
- Goals scored in this round.
- Head to head game of this round.
- Two extra halves of 3 minutes each (only in cases where it matters for advancing to the next round or define the ranking in the 9<sup>th</sup> to 12<sup>th</sup> places round)
- Penalty shoot-outs (for 2-team ties only)
- Coin toss

## Semi Finals and Finals

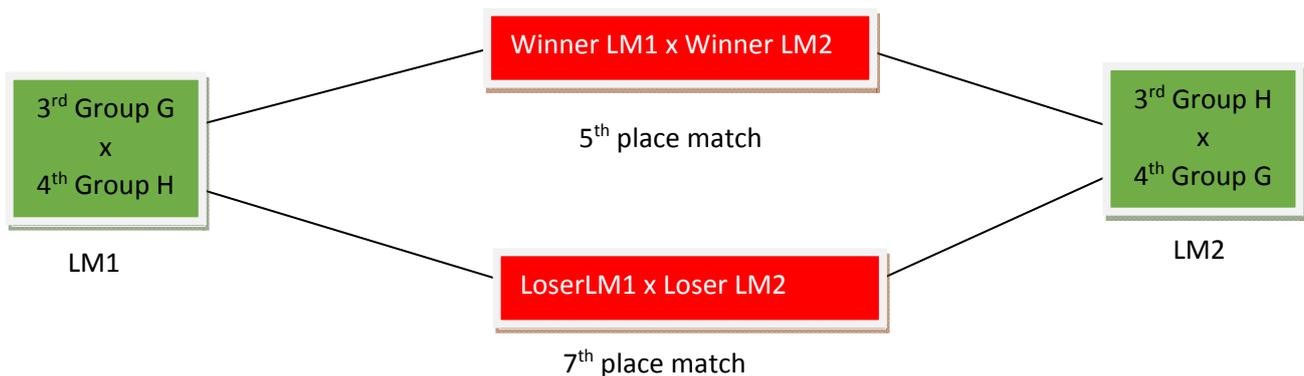
After the third round, a knock-out system is used. The first of each of the groups in round second plays the second of the other group. The winners of these matches will play against each other in the final. The losers will play a match to decide who wins the third prize. The losers of round second will play a Loser's Bracket to rank 5<sup>th</sup> to 8<sup>th</sup> place. If a knock-out game ends in a tie, two extra halves are played. If these end in a tie as well, a penalty shootout determines the winner. In the knock-out matches, the winner will be determined in the following order:

- Number of goals scored in the game
- Two extra halves of 3 minutes each
- Penalty shoot-out
- Coin toss

### Winners' Bracket



### Losers' Bracket



### **Gazebo Challenge**

In order to support the efforts of evaluating the possibility to switch to a gazebo based simulator, this year we have a competition run in the new gazebo simulator. The number of players per team and other details for this challenge will be chosen depending on the state and speed of the new simulator. A first version of the gazebo based simulator is available at <https://bitbucket.org/osrf/robocup3ds>.

The goals and advantages of this challenge are:

- more support and interaction from our community for the developers of the simulator
- participation is voluntary, so teams that do not feel confident to prepare it, do not have to
- participating teams have the advantage that they get points for the technical challenge trophy
- participating teams also have the advantage that they are one year ahead of non participating teams if we finally decide to switch

- for all it has the advantage that we can decide if we want to switch on a much more solid base.

The competition format will be decided once the number of teams participating is known. It will probably be a tournament with one group if the number of teams is five or less.

### **Scientific/Free Challenge**

The Simulation 3D scientific/free challenge is a presentation/demonstration competition that intends to encourage scientific work development and sharing in the context of the Simulation 3D league, allowing the teams to present interesting research work developed using Simspark and RCSSServer3D simulation platform. Each team will be given five minutes to present and demonstrate an interesting research topic of their team. Teams should deliver to the simulation technical committee a short, one page description of their intended presentation prior to the competitions (deadline: July 26, 6pm: posting to [rc17\\_sim3d\\_oc@kis.osakafu-u.ac.jp](mailto:rc17_sim3d_oc@kis.osakafu-u.ac.jp)) in order to be distributed to all other teams and the jury during the competition. Presentations must be focused on only one significant research topic of the team and should not describe the whole team like in a TDP. Presentations, besides describing the scientific issue, must also show a demonstration using the RCSSServer3D simulator. Demos should show real-time execution of the simulator, however they may also include pre-recorded videos and demonstrations of other related software tools. The winner is found by a voting process.

The presentation files of last year are able to be found at: [http://wiki.robocup.org/Soccer\\_Simulation\\_League/RoboCup2016#Scientific\\_Challenge](http://wiki.robocup.org/Soccer_Simulation_League/RoboCup2016#Scientific_Challenge)

### **Passing and Scoring Challenge**

The rules for this challenge will be announced soon and deliver the document to the mailing list.

### **Challenge Trophy Rules**

A trophy will be awarded for the team with the highest combined score on the three challenges. The combined score will be calculated by the following rules:

- Each participating team in a challenge is given a score between 5 and 25 with the winner of a challenge receiving 25 points and the last place team in a challenge receiving 5 points.
- Teams not finishing first or last in a challenge receive a score based on a linear equation of their finishing spot in the challenge.  $score = (number\_of\_participants - rank) / (number\_of\_participants - 1) * 20 + 5$ . Example: If there are five teams participating in a challenge then 1st place = 25, 2nd = 20, 3rd = 15, 4th = 10, 5th = 5.
- Teams not participating in a challenge receive 0 points for that challenge.

The overall winner of the challenges is the team with the highest total sum of points earned across all the challenges.

## General Rules

- **Match Preparation and Format**

**1. Set-up:** The OC will supply upload instructions at the first day, which teams must use and follow to be able to run their agents. Teams will be given the opportunity to upload and test their agents on the competition system before the start of each round. When a round is started, it will no longer be possible to upload or make changes to the agents, until all matches of that round have been played.

**2. Start/end:** The matches will be started automatically by a competition managing system. Teams are required to provide scripts named `start.sh` and `kill.sh` for running and terminating their team. All players of a team must be running in less than 15 seconds when `start.sh` is executed. Additionally, each team must provide scripts named `start_penalty_kicker.sh` and `start_penalty_goalie.sh` to run their penalty kicker and goalie respectively. The IP address that the agents should connect to is given as the first parameter to the start scripts. Examples of start and kill scripts can be found on the SSL wiki.

**3. Team format:** A match is played by two teams of 11 players. A match may not start if either team consists of less players. Each match consists of two halves of five minutes each. After the first half the teams switch sides. Each player can select any available agent models, possibly forming a heterogeneous team. The details of the available models were previously announced. The possible team composition is described in the heterogeneous player section of this document.

**4. Representation:** For a match, each team has the chance to appoint a single team member as the team's representative. This representative should announce himself to the referee before the start of the match, otherwise it is assumed that the team has none for this match. During the match, only the team's representative can approach the referee.

**5. Forfeiting rule:** We define forfeiting as refusing to make a good faith effort to participate in a scheduled game. A team that forfeits is disqualified from the competition. In round-robins, when a team forfeits all the scores will be 3x0 against this team. In a knock-out round the teams who forfeits will be replaced by the next team in the rank from previous round.

**6. Faulty agents:** When a match has started and an agent shows clearly unnatural behavior or gets disconnected, the following rules apply:

- If this occurs in the first 30 seconds of the match, the match will be restarted up to 2 times. In the case of unnatural behavior, the team's representative is responsible of notifying the referee, who will make the binding decision whether to restart the game on his own discretion.
- If the problem persists after restarts, the team's representative can ask the referee for a 2 minute time-out to fix the problem. A fix may include the use of a binary from a previous round.

- If the problem still persists after the time-out, or if it occurs after the first 30 seconds of the match the game will continue. If due to the problem the team ends up with less than the minimum amount of players, the match will result in a win by the average score against this team but at least 1:0.

- **Heterogeneous Players**

Each team has to use a minimum of 3 different player types and no more than 7 players from one player type. If only 3 different player types are used then a minimum of 2 players for each type must be used. The standard player type is counted identically to heterogeneous player types. Possible configurations for the different player types are: (7-2-2), (7-1-1-1-1), (4-4-3), (3-3-3-2), (3-2-2-2-2), etc. If teams do not comply with this rule, the server will not allow the faulty player to connect (that is either the 8th player of a given player type or the first player that does not allow the '3 player types' rule to be fulfilled). The heterogeneous types that were used last year will also be used during this year's competition.

- **Game Play**

**1. Kickoff:** Goals scored directly from the kickoff are not accepted. Also, the agent performing the kick-off may not touch the ball again until it was touched by another player. In case of infringement, a kick-off is awarded to the opposing team. A goal can be scored after a kickoff only if a second player from the team performing kickoff touches the ball outside the main circle or if an opponent touches the ball.

**2. Goalkeeper:** The player with uniform number 1, and only this player, will be designated as the goalkeeper.

**3. Handling the ball:** Handling the ball involves a deliberate act of a player making contact with the ball with his hand or arm, as decided by the referee on his own discretion. Handling the ball is penalized with a free kick to the opposing team. The goalkeeper cannot be guilty of a handling offense when his hands are within his own penalty area.

**4. Obstructing the ball:** Obstructing the ball involves use of a player's body, arms or legs to prevent progress of the game, which includes covering the ball, carrying the ball, holding the ball between arms or legs and lying in front of the goal in an attacking situation. Deliberately obstructing the ball, as judged by the referee, for longer than 10 seconds is penalized with a free kick to the opposing team. Unintentional obstruction of the ball for longer than 10 seconds is ended by a drop ball by the referee.

**5. Illegal defense:** At any time during the match, no more than 3 players of a team may be inside of their own penalty area. If a 4<sup>th</sup> player enters the penalty area, it will be placed outside of the field. When the last to enter is the goalkeeper, the player furthest away from the own goal of the three that were already in the penalty area will be placed outside of the field instead.

**6. Immobility:** Players that have been immobile or fail to stand up for too long will be repositioned. The goalkeeper will be repositioned after 30 seconds of immobility, or after

failing to stand up for 60 seconds; other players will be repositioned after 15 seconds of immobility, or after failing to stand up for 30 seconds.

**7. Penalty shoot-outs:** During a penalty shoot-out, each team only has a single player in the field: the goalkeeper for the defending team and a striker for the attacking team. Each penalty shot starts with a kickoff. The attacking team gets 40 seconds to attempt to score. The goalkeeper of the defending team has to stay within his penalty area the whole of this time. If neglected, it will be considered as a goal for the attacking team. When penalty shots are used to decide a tied game, each team gets five penalty shots. If after five penalty shots the score is still equal, sudden death rounds of one kick each are used until one side scores and the other does not. If after ten penalty shots no winner is determined, a coin-toss is used to decide.

**8. Colliding with other players:** Players must avoid touching other players. If three or more players get in touch with each other, a player from the team with the most players in this situation, or a random player in case of an equal amount, will be re-positioned outside the field. The following collision events are considered fouls and can be rewarded with a free kick to the opposing team, if they result in tripping, obstructing, blocking, slowing down or forcing a change of direction of an opponent: running into an opponent from behind, and moving in the path of a faster moving opponent (illegal interception). Such fouls will now be called by the automated referee. Fouling players will be beamed outside the field as with other fouls. Details of what is considered a foul are described in:

<http://www.acso.uneb.br/bahiar/uploads/Main/FoulModel2016.pdf>

**9. Output:** Each player is permitted to generate output in files named stdout and stderr with the player number appended (e.g. stdout3 and stderr3 for player number 3). These write-only files will be located in their home directory under a log/subdirectory. Except these files, the home directory is read-only during the games, so agents should not try to open any other file for writing.

**10. Fair play:** Games should be played according to a fair and common-sense understanding of soccer and to restrictions imposed by the virtual simulated world of the 3D soccer simulator. Circumvention of these is considered violating the fair play commitment and is strictly forbidden during the tournament. Violation of the fair-play commitment includes, but is not limited to, for example:

- using another team's binary in your team
- jamming the simulator by sending excessive commands per client
- direct communication between players by using communication means other than those provided by the simulator, such as inter-process communication
- manipulating competition machines or restarting them intentionally

Any of these is strictly forbidden. Other strategies might be found violating the fair play commitment, after consultation with the OC. However, we expect it to be clear what a fair team should be like. In particular, the destructive disruption of opponent agent operation or the gain of advantage by other means than explicitly offered by the simulator counts as not fair play. If you are in doubt of using a certain method, please ask the OC before the

tournament starts. If a team is found to use unfair programming methods during the tournament, it will be immediately disqualified.

- **Referee**

During each game a referee is appointed to enforce the rules laid out in this document. In situations that are not handled by the rules, the referee should decide based on his/her common sense. The referee can be a member of the OC or a volunteer, from a team other than the teams of the match, who has full knowledge of the rules as deemed by the OC. During a match only one representative of each playing team is allowed to approach the referee. Decisions of the referee are binding and cannot be appealed during a match. If there is any complaint about a game or a decision, this should be brought to the OC's attention as soon as possible, who will decide how to handle it after all games of the current round are finished. If the referee cannot decide in a situation, he can consult the OC who will give the final decision. Each team must supply a volunteer to be a referee, preferably the same as the team's representative.

- **Publication of Logs and Binaries**

The OC will make the logfiles of the matches available to the participating teams during the competition. After the competition, the OC will also publish these logfiles on the internet at their earliest convenience. The OC will also publish the binary, and additional files needed to run this binary, of each team after the competition. To do this, at the start of each round the home directory of the teams participating in that round will be archived. The team's last archive will be used for publication. If the home directory contains material that a team wishes not to be published and that is not needed to run the binary, it is the responsibility of the team to notify the OC of this. Note that teams that have used third party source code must follow that code's license regarding conveying the work. For instance, under GPL you are required to accompany your binary with the corresponding source, a written offer to supply the corresponding source, or information about where the source is offered to the general public. Failing to comply with any licensing will result in disqualification of the team from the current and/or future competitions.