

The Freescale Cup 2012-2013 Season Rules



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<http://streetsmarts.freescale.com>



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Section 1: Overview

All racing teams will use the vehicle model suite designated by Freescale Semiconductor. The Microcontroller/Microprocessor Board from Freescale Semiconductor is the core control unit. Only the authorized boards are allowed for use during the official race. The teams should design the software control scheme and racing vehicle system hardware themselves. The software includes sensor-imaging collection and processing, drive motor control, and steering motor control algorithm development. The teams are required to design motor control hardware, as well as the sensor interface hardware.

The judging committee of the event will rank teams using the racing rules contained in this document for the preliminary and final competitions. Equality and fairness will be ensured as much as possible. The Freescale Cup committee will invite guest judges to evaluate and qualify vehicles, as well as insure quality of the race.

Section 2: Team Rules and Requirements

1. Undergraduate students from an enrolled college or university may participate. Up to 1 graduate student (in master program) can be part of the team
2. Each department/faculty may have up to 3 racing teams to be represented to the official Freescale competitions depending of space availability during the finals. If need be, Freescale can raise or lower the number of maximum teams per department/faculty. Internal school competitions can be discussed on a case-by-case basis only.
3. The maximum number of people on a team is 3
4. Vehicles will be designed and constructed by students only. This includes the vehicle chassis, external circuitry, software development, etc.
5. Students are required to submit a final technical report of their vehicle to participate in the racing event.
6. Participants are expected to exhibit good sportsmanship. Any inappropriate behavior or cheating will result in disqualification.

Section 3: Equipment Requirements

Each team will be provided the same Freescale Cup kit.. The spirit of the The Freescale Cup is to demonstrate excellent hardware integration and superior programming.

1. The following original and unaltered equipment must be used in the design.
 - a. Tires
 - b. Drive - DC motor

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- c. Transmission Ratio of Drive Motor
 - d. Servo Motor
 - i. Excludes connection component on output axis of the rudder
 - e. Battery (NiMH 7.2V, 2400mAh)
 - i. Only one (1) battery at a time may be used to power the vehicle and hardware
 - f. If any standard component of the vehicle model is damaged, then a replacement part of the same model should be used.
2. The chassis can be modified, with some restrictions:
 - i. The footprint of the frame may not be altered
 - ii. You may not change the distance between wheels
 - iii. No part of the vehicle design shall exceed dimensions of 250mm/9.85in (W) x 400mm/15.75in (L)
 - iv. You may drill holes or install auxiliary racks on the chassis
 3. Additional external circuitry and sensors can be added.
 4. The main microcontroller/microprocessor control board may be modified.
 5. Teams are allowed to create custom circuit boards.
 6. No auxiliary processor or other programmable device is allowed besides the Freescale microcontroller (see Appendix A for list of authorized controllers).
 7. Wireless connectivity to the vehicle during the race is not allowed
 8. DC-DC boost circuit cannot be used to power drive or steering motors.
 9. Total capacity of all capacitors should not exceed 2000 μ F; the highest charging voltage of capacitors should not exceed 25 V.
 10. One (1) microcontroller processor in the control board
 11. Teams must use one of the following motor control options:
 - a. Freescale H-Bridge such as MC33931 or MC33932
 - b. Discrete analog components
 12. The software shall be created using CodeWarrior Development Tools and RappID Initialization for the controller architecture chosen by the team and allowed for the race.
 13. NO REPRODUCTION IS ALLOWED IN DESIGN OF THE VEHICLE MODEL. HARDWARE AND SOFTWARE OF VEHICLE MODELS OF COMPETING TEAMS WITHIN SAME UNIVERSITY SHOULD BE ORIGINAL AND CLEARLY DIFFERENT.

Section 4: Referee and Technical Judgment

The Freescale Cup will be carried out by the undertaking colleges/universities under direction of the organizing committee of the event.

Judge: responsible for non-time based judging activities. This includes design judging and/or report judging

Referee: responsible for activities related to the racetrack. This includes start/stop

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activities on vehicles as well as timing and scorekeeping

1. The submission of a Technical Report is mandatory to continue in the competition. Teams that do not turn in a Technical Report by the specified date will be disqualified and must return the provided hardware to Freescale.
2. During the race judges will perform a technical inspection for all entries: This includes vehicle specifications, dimensions, and non-modifiable parts and use of wireless connectivity (Wi-Fi, Bluetooth or other). In the event of any violations, the organizing committee is entitled to disqualify the corresponding team.
3. Any racing disputes will be taken up and resolved by the racing committee.
4. Workers of the racing committee or the event team shall not participate in coaching or training for any specific racing team (except for microcontroller training) and shall not disclose any information that might compromise fairness of the competition.

Section 5: Racing Procedure

1. The agenda of the race is to be issued by Freescale at least 7 days prior of the date of the race. The agenda can be altered on short notice to adapt to special situations that may arise during the racing days.
2. Racing order will be randomly set by the race committee and posted on –site
3. A qualifying race may be used to limit the number of teams competing in the final race
4. Before the race begins, all vehicles will be collected and displayed. Teams will not be allowed to modify software or hardware of the vehicle from this point forward.
5. A referee will direct the racing teams when to enter the playing field in accordance with the racing order.
6. There shall be only one team on the track at any given time.
7. After being called by a referee, each racing team should designate a member to take their racing vehicle to the playing field and place it in the starting area of the racing track. Other team members must stay outside the racetrack.
8. Event displays will post the best time for a single lap.

Section 6: Racetrack Care

1. No hard or black soled shoes allowed on the track.
2. Do not step on the track surface.
3. Do not step near the timing gate.

Section 7: Practice

1. Prior to the official race, each racing team can test the track environment on

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site. The test-racing track may be different from the actual racing track in shape but their material and environment will be the same. Final calibration may be made at this time.

Section 8: Timed Racing (On the Track)

1. The judges will perform on-site technical inspection that all the vehicles comply with the rules.
2. A team has two minutes to set up the vehicle and signal "Ready" to referee.
3. Vehicles must be placed a maximum of 3 feet (1 meter) from the starting line.
4. After the referee announces the start of the race, the vehicle should leave the starting area within 30 seconds.
5. The vehicle should leave the starting area without any assistance.
6. The vehicle should stop after crossing the finish line within 9 feet (3 meters)
7. Once the vehicle stops, a member of the team shall take the vehicle away from the track.
8. Each team is given two discrete attempts to complete one lap of the track and post a time.
9. Teams that cannot complete the track after two attempts are disqualified.
10. If there are multiple tracks, teams cannot use the same track for the second attempt.
11. The shortest time for a single lap is recorded.
12. The next vehicle in ranking will replace disqualified vehicles.

Section 9: Qualifier Race (Optional)

1. Based on the number of participating teams, the racing committee may use a qualifying race to set a certain limit of racing teams that can advance to the finals. Equally, the racing committee may elect to run additional qualifying races to ensure that the targeted number of teams advance to the finals.
2. After the preliminary round, the vehicle hardware or software can be improved in compliance with competition rules. Changes must be reported in the Technical Update Sheet.

Section 10: Rules for Fouls and Disqualifications

Freescale and the racing committee of the event will interpret the rules.

1. During a team's racing, the on-site referee will judge whether the racing vehicle ran out off the racetrack. Running off the track is defined as any wheel going off the track.
2. If a vehicle runs off the track, the score of that lap will be considered invalid.

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3. Any of the following conditions will be considered a failure and no time will be given:
 - a. The vehicle fails to leave the starting area within 30 seconds after beginning of the race
 - b. The vehicle fails to stop 9 feet (3 meters) after the finish line, after completing the lap
 - c. The racing team fails to enter the playing field and get prepared for the racing in two (2) minutes after being called by the referee.
 - d. The player touches the racing vehicle after the beginning of the race without consent of the referee.
 - e. The vehicle fails to finish the lap within 120 seconds after leaving the starting area.
4. No time will be given for a disqualified team. Any of the following conditions will be considered a disqualification:
 - a. Any auxiliary lighting equipment or other auxiliary sensors around the racetrack or wireless connection to the vehicle
 - b. Modification of the hardware or software after the race has begun except for changing the battery.
 - c. More than one team member in the playing field.
 - d. Any behavior that might interfere with the movement of the vehicle.
 - e. Any cheating during the competition.
 - f. Plagiarizing the vehicle design including hardware or software. Vehicles from the same University but different teams must be clearly different.
 - g. Failure to pass the technical inspection.

Section 11: Scoring

1. Equality and fairness will be ensured as much as possible on the condition of actual feasibility. Disputes will be resolved by a vote of organizing committee and judges.
2. Time starts when the race vehicle crosses the start/finish line.
3. Disqualifications and Failures will result in no score.
4. Time will be captured using an electronic gate or handheld timer.
5. Vehicle design judging will be scored on the quality of construction, appearance, and creativity.
6. Technical report judging will be scored on quality of content, design approach, and concept understanding.
7. The score from the preliminary racing round will not be included in the score of the final racing round.
8. The final score shall be determined by the better time of the two opportunities to complete 1 racetrack lap of the vehicle.

Section 12: Awards

The final ranking will be determined by the best racing times. Awards will be given to the top three teams who have the highest rank. The racing committee might provide additional awards. Those should be communicated at least 3 months prior of the date of the finals.

Section 13: Technical Report Requirements (Optional per region)

Technical reports will be reviewed and rated by the experts invited by the organizing committee of the event. Technical reports should be clear with detailed text, diagrams, and bibliography. Technical reports must contain a brief description of major concepts and specific technical implementation schemes for design and production of vehicle models including:

1. Description of mechanical design of vehicle model
2. Description of control circuit design
3. Description of the electronics design
4. Description of control software design
5. Total weight and dimensions of the reengineered vehicle
6. Power consumption
7. Count and type of sensors used
8. Number of servo motors besides the existing driving motors and rudder motors of the vehicle model
9. Written in English
10. Formatted for either Microsoft Word or PDF
11. Submitted via email to the Freescale contact four weeks prior to the race

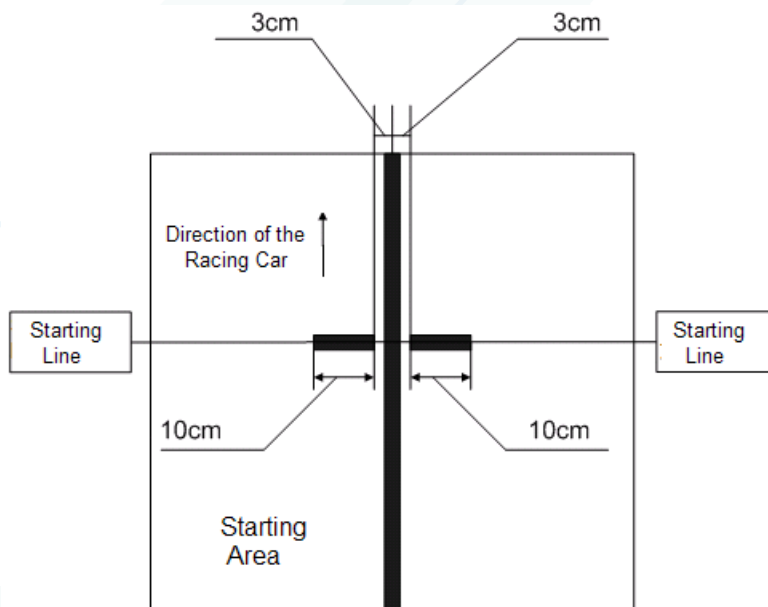
Upon arrival at the final competition, each team must submit a printed document with any changes from the initial technical report submitted four weeks prior to the race date.

Section 14: Parameters of the Racing Track

1. Track design files are available online for teams wanting to create a test track
2. The layout of the final racing track is unknown to the competitors until competition day
3. For a limited time on race day, a test track made from the same material may be available on a first come, first serve basis for calibration and design modifications.
4. Organizer is not responsible for meeting the predefined lighting conditions for the racing track area.
5. Width of the racing track shall not be less than 600mm/23.65in.
6. Material specifications regarding the surface of the racing track will be provided on the web site of the event.

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7. Surface of the racing track is matte white, with a continuous black line (25mm/1in wide) drawn in the middle as the pilot line.
8. The minimum-bending radius of the racing track shall not be less than 500mm/19.7in.
9. The racing track can intersect with a crossing angle of 90°.
10. Any slope in the track will be equal to or less than 15 degrees in a straight section of the racing track, including upgrade and downgrade.
11. There is a straight starting area of 1000mm/39.4in long in the racing track, as shown in figure below. In addition, there is a black starting line 100mm/3.9in long at both sides of the starting point. Start time and end time will be determined when the front part of the racing vehicle passes the starting line. The vehicle must be able to automatically stop within 9 feet (3 meters) of the starting line after finishing the race.



Section 15: Disputes

1. Equality and fairness will be ensured as much as possible on the condition of actual feasibility. Disputes will be resolved by a vote of race committee, referee and judges.

APPENDIX A

The current processing boards allowed for the 2012-2013 Season are:

- TRK-MPC5604B
- TWR-K40X256-KIT

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The rules and conditions are subject to change by Freescale if necessary. Freescale reserves the right in their sole discretion to cancel, suspend and/or modify The Freescale Cup race at any time. These official rules are drawn up in the English language. If these official rules are provided in any other language and there is a conflict in the text, the English language text shall prevail.

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