**2015 4-H Robotics Challenge**  
*Autonomous/Driver Control 4-H Robotics Challenge*

The 4-H Robotics Challenge provides an opportunity for 4-H members interested in science, engineering and technology to participate in a hands on, team based activity of building robots.

**Game Manual**

1.0 Teams

1.1 Teams will consist of 2 to 4 Junior, Intermediate or Senior 4-H members. Teams of mixed age groups are allowed, but the oldest member on a team establishes the age group applicable to the team. Please note that any team who wishes to compete for the National 4-H Engineering Challenge trip must be made up entirely of Senior (14 years old before January 1, 2015) 4-H members. While Junior and Intermediate team members may compete on a Senior team at the State Fair, they do not qualify for the National Trip. Mixed teams of Intermediate and Senior 4-H members also will not qualify for the National Trip. The top ranked team made up of entirely Senior 4-H members will earn the opportunity to represent Maryland at the National 4-H Engineering Challenge.

1.2 The team must have an adult coach who has completed the Maryland 4-H UME Volunteer training.

1.3 Senior teams and team members who have previously won the State contest may not compete in the 2015 contest.

2.0 Robot Design- This section provides rules and requirements for the design and construction of your robot. The robot is a remotely operated vehicle designed for the game.

2.1 Robots can be constructed from materials and/or from any robotic platform of the teams’ choosing as long as all other rules are met.

2.2 Motors- A robot may utilize no more than 10 motors or servos.

2.3 Batteries- The robot shall be powered by non-spillable batteries. The battery voltage shall not exceed 12 volts and the total battery capacity of the batteries used on the robot shall not exceed 6000 mAh.

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1 The intent is to allow teams to compete using a robot assembled from hardware from a commercially available robotics platform, a robot built from materials purchased from a variety of local sources (hardware stores, electronics stores), or a hybrid of hardware from more than one robotics platform and/or additional materials purchased at local sources.

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2.4 Radio Control- Robots must use radio control for tele-operated operation. No tethered
operations will be allowed on the field. Teams may use any radio control system as long as it
has been approved by the superintendent for use. To gain approval, the team must submit a
completed copy of the documentation contained in Annex 1. The VEX Robotics V.5 crystal-
based radios, the VEX Robotics VEXnet radios, the LEGO Bluetooth radios, VEX IQ radios and
the TERIX (FTC) Samantha Radio are already approved for use. Teams do not need to submit
approval requests for these radio systems. New radio systems must be shown to be
compatible with these existing radios in order to gain approval for use.

2.5 Microprocessor- Any microprocessor may be used in the design. It is the responsibility of
the team to ensure their microprocessor is compatible with the batteries, motors and radio
control system that they have selected.

3.0 Robot Inspection - Each robot will be required to be inspected by an inspector during the
registration time. This inspection will ensure that the robot rules are met. If the robot does not pass
inspection the team will be allowed to modify the robot and have it be re-inspected, but may not
compete until the robot passes inspection.

3.1 Robot Size- The robot must fit inside of a 18” X 18” X 18” sizing box without applying any
pressure on the sizing box. A sizing box will be used during inspection to determine if the robot
meets the size requirement. Once the match starts the robot may unfold to any size.

3.2 Robot Weight- The robot may weigh no more than 20 pounds with batteries
installed. A scale will be used at inspection to ensure the robot meets this
requirement.

4.0 Robot Control- An official field clock will be provided, however each team must provide their own
means to start and stop their robot in the autonomous and tele-operated portions of the game. Start
and stop commands will be given by the referee based on the official field clock.

4.1 Autonomous Period Operation

4.1.1 Teams should utilize or design autonomous software to begin autonomous
operation with minimum interaction with the robot. A designated member will be
allowed to press a button on the robot at the beginning of the autonomous period if
required. No manipulation of the robot or part of the robot is allowed when starting
the autonomous program.

4.1.2 The autonomous program shall automatically terminate or be terminated by
computer or control electronics from the side of the field at the time the referee gives
the “stop” indication. The robot will be left in the position it stopped in at the end of
the 30 second autonomous period. Any game pieces scored after the 30 second
autonomous period will not be counted and will be returned to the playing field.

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4.2 Tele-Operated Period Operation

4.2.1 Each robot must be controlled through wireless controllers. Two team members designated as the drivers may control the robot. One additional team member may be at the field for support. No team members or adults may coach from sidelines or spectator seating.

4.2.2 Teams should design their tele-operated software to start the tele-operated period of the game with minimal interaction of the robot. A designated member will be allowed to press a button on the robot at the beginning of the tele-operated period if required.

4.2.3 Once the Autonomous or Tele-Operated periods begin, no member of the team will be allowed to touch or in any way manipulate a robot or game piece. If a member touches or manipulates the robot or a game piece, the team will be disqualified for that match.

5.0 The Game

5.1 The Field

5.1.1 The field will be a standard 12’ X 12’ Vex/FIRST Tech Challenge field.

5.1.2 The floor of the field will be covered with standard foam Vex/First Tech Challenge foam floor tiles. Note that the field tiles are installed with the unfinished side up.

5.1.3 The game object for this game will be a 4-inch diameter, ¼-inch thick plywood disk with a 1-inch hole in the center.

5.1.4 The field will have four floor goals (two for Red and two for Blue) in the corners of the field, two Wall Goals mounted on the field perimeter walls, and Center Goal Assembly in the center of the field.
5.1.5 The floor goals are triangles taped on the field floor. The length of the floor goal along the field wall is 16 inches.

5.1.6 The Wall Goals are mounted on the walls of the field perimeter opposite the location of the team’s driver station.
5.1.7 The Center Goal Assembly is located in the center of the field. The Red Team scores on the Red side and the Blue Team scores on the Blue side.

**FIGURE 3- Center Goal (dimensions in inches)**

5.1.8 The field will be taped as shown in Figure 4.
5.1.9 The disks will be placed on the field along the white tape lines as shown in Figure 1. In addition, 6 disks of each color will be placed on the divider board on the Center Goal as shown in Figure 3. The color of the disks on the divider board will be opposite of the field area color for that side of the Center Goal.

5.1.10 The starting position of robots is on the two tiles where the color matches the color assigned to the team for that match (red or blue). The robot must only touch the colored tile, not the surrounding gray tiles or the field wall.

5.2 The Challenge

5.2.1 The goal of the game is to score the disks on the low, medium and high goals.

5.2.2 The disks scored on the low goal are worth 1 point. To be scored the disk must not be touching the scoring robot and at least 50% of the disk must fall within the vertical projection of the goal.

5.2.3 The disks scored on the Wall Goal of the correct color are worth 6 points each. To be scored a disk must be positioned such that the dowel extends into or through the center hole, and not be touching the scoring robot.

5.2.4 The point value of disks scored in the Center Goal is 4 points. To be scored a disk must be positioned such that the dowel extends into or through the center hole, and not be touching the scoring robot.

5.2.5 Pinning for more than 5 seconds will result in disqualification from the match (a loss). Pinning is defined as holding your robot holding your opponent’s robot against an immovable game object. Disks against an immovable object also count as an immovable object.
5.2.6 Entrapment for more than 5 seconds will result in disqualification from the match (a loss). Entrapment is blocking your opponent in a small area defined by immovable objects so that they have no path to escape.

5.2.7 In driver control you may only interact with (push) your opponent’s robot once their robot has at least partially crossed the team dividing line onto your side of the field (Field Zone). You may not interact with your opponent’s robot if their robot is entirely within their Field Zone. Failure to adhere to this rule will result in disqualification from the match after one warning is issued. Moving in front of robot so that you block your opponents path of travel is acceptable anywhere on the field provided 5.2.5 and 5.2.6 are not violated.

5.2.8 During autonomous a robot may not make contact with their opponent’s robot in their opponent’s Field Zone. If this occurs the opponent automatically receives the autonomous bonus regardless of the points scored during the autonomous period.

5.2.9 Each team may use 3 preloads for the autonomous portion of the match. Preloads can only be placed on the robot but not touch the field tiles or field walls. Preloads do not need to be used. They may not be introduced to the field once the match has started.

5.2.10 The Autonomous Bonus of 10 points is awarded to the autonomous period winner.

5.2.11 A disk is not scored if it is touching the robot of the same color.

5.2.12 A team may not posses more than 6 disks at one time. Possession includes holding, carrying and herding. The first offense in a match will result in a warning. The second or continued offense after the warning will result in disqualification.

5.2.13 Intentionally placing disks on your opponent’s robot will result in disqualification.

5.2.14 Disks may not be intentionally ejected from the field area. First offense will result in a warning. A repeated offense during the contest will result in disqualification for that match.

5.2.15 Each team will have a bonus disk (colored red and white, or blue and white, depending on team color) that may be entered into play in the last 30 seconds of the match. The disk is entered into play by placing the disk in the approximate center (at least 4” from any edge) of the starting tile. While the robot is not touching or hanging over the starting tile. The bonus disk scored in the wall goal doubles the value of the other disks scored on that goal. Scored on any other goal, the bonus disk has no value. A bonus disk that is put in play but is unscored at the end of the game will result in 10 point deduction from the team’s final score.
6.0 Official Questions about the Game- If you have questions about the game, e-mail them to Willie Lantz at wlantz@umd.edu.

7.0 The Tournament

7.1 Matches- Matches will be 2 minutes and 30 seconds in length. The first 30 seconds will be the autonomous period. The remaining two minutes will form the operator control part of the match.

7.2 Ranking- A team will earn two points for each Match win and one point for a Match Tie. Teams will be ranked using the total of points earned for Match Wins and Ties, plus the points earned for their Engineering Journal as discussed under Section 8.0. In the event that two teams are tied in rankings, they will play an additional match to break the tie.

8.0 Engineering Journal and Judge Interview

8.1 The engineering journal will be used to document the teams design process in building the robot from design concepts to finished product. Team members should document your work in the journal each time your team meets to work on the robot. Record your obstacles, lessons learned and successes of your designs. Place information in the journal about testing procedures and results of tests. Any format may be used for the journal.

8.2 The Engineering Journal will be presented and evaluated during a Judge Interview. An interview will last 15 minutes. The team should be prepared to present their design, team activities and other items of interest, but also allow time for the judges to ask questions during the interview period.

8.3 The maximum value of the Judge Interview is 50% of the total match Points that can be earned under 7.2. For example, if each team plays 5 matches, there is a potential for a team who wins every match to earn 10 Points. In this case, that maximum score that can be earned for the Engineering Journal Interview is 5 points.

8.4 If the Judges use a different score system that does not match the point value as stated in 8.3, the judging scores will be scaled to match the scoring system as discussed in 8.3.

8.5 Each team’s Judge Interview Score will be added to their Total Match Points for a final ranking score. Ties will be broken by tiebreaker matches.

9.0 Field Construction Drawings

9.1 Field Construction Drawings will be posted to the University of Maryland 4-H Robotics Website as a separate document.

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Annex 1
Radio Approval

Radio Manufacturer: _________________________________

Radio Model Number: _________________________________

Radio Manufacturer technical point of Contact Name: _________________________________

Radio Manufacturer technical point of Contact Phone Number: __________________________

Radio Manufacturer technical point of Contact Email: _________________________________

Frequency range(s) of Radio System: ___________________________________

Does the system use any of the following technologies?

☐ Bluetooth

☐ 802.11B/G

☐ 802.11 A/N

Is the radio frequency setting adjustable?  ☐ Yes  ☐ Manual

☐ No  ☐ Automatic

NOTES:

- The goal of this requirement is to ensure all competitors can operate without concern over interference caused by other robot radio links. All efforts will be made to allow new hardware. The intent is not to discourage use of new hardware.

- The team may be required to submit a radio system for compatibility testing against the already approved devices. The equipment will be returned once testing is complete.

- It the responsibility of the proposing team to provide all requested information, additional information and hardware for testing. The team may also be required to provide an equipment operator at the time of compatibility testing.

- Approval is not guaranteed. Inability to obtain necessary information (on his form or additional), lack of hardware for testing and/or suspected incompatibility with already approved radio systems will result in rejection of the hardware for use in the State Fair contest.

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