Rules 2017
Savage Soccer 21 - Lift Off

If you have any questions about rules or the event, you may email them to savage@wpi.edu. All responses will be publicly dispersed on the website under the Updates link). Please read the rules and Updates page before asking questions as they may already be answered.

1. Objective
To design and build a radio and autonomously-controlled robot that will defeat your opponents in competition.

The winner of the competition is defined as the coalition that wins all best two-out-of-three rounds in the elimination bracket.

2. The Game

2.1 Definitions:

2.1.1 COALITION: Two teams which work together to defeat another coalition in competition. Coalitions are chosen randomly (in qualification rounds) or drafted (in elimination rounds). A coalition's teams always share a color.

2.1.2 COALITION COLONIALS: The top-ranked teams at the end of the qualifying matches.

2.1.3 ORB (Ordinary Robot Balls) : One of fifty (50) 38mm (~1.5 in) diameter ping pong balls.

2.1.4 ASTEROID (Awesome Spherical Tennisballs Extraterrestrially Rotating and Orbiting In a Disk) : One of twelve (12) 2.70" diameter tennis balls.

2.1.5 STAR: One (1) 8.5" diameter kickball.

2.1.6 BLACK HOLE (Bot Landing Area Coalitions Keep Holding in Order to not Lose the Endgame) : A 12 inch diameter region in the center of the field outlined by a taped down, 0.225" diameter tube; the region is defined by the inner radius of the tube, and extends infinitely vertically upwards.

2.1.7 BASE (Big Awesome Starting Exoplanets) : Area at the ends of the field defined by the field borders and a line of tape, 18" in depth, and spanning an infinite height upward.

2.1.8 ORBITS (Orb Retaining Big Incredibly Tall Structures) : A structure consisting of a clear 3" OD, 2 7/8" ID tubing with a funnel on the top and a square support on the bottom.

2.1.8.1 For scoring purposes, the square support does not count as part of the ORBITS.

2.1.8.2 ORBITS Level 1

2.1.8.2.1 Combined height is 5.625".
2.1.8.2.2 Located 30" away from the each end of the field and 6" away from the top and bottom of the field. RED's ORBITS 1 is located closer to RED's BASE and BLUE's ORBITS 1 is placed from the opposite corner.

2.1.8.3 ORBITS Level 2
2.1.8.3.1 Combined height is 11.625".
2.1.8.3.2 Located 48" away from the each end of the field and 48" away from the top and bottom of the field. RED's ORBITS 2 is located closer to BLUE's BASE and BLUE's ORBITS 2 is placed from the opposite corner.

2.1.8.4 ORBITS Level 3
2.1.8.4.1 Combined height is 17.625".
2.1.8.4.2 Located 36" away from the each end of the field and 6" away from the top and bottom of the field. RED's ORBITS 3 is located closer to RED's BASE and BLUE's ORBITS 3 is placed from the opposite corner. These two corners differ from the ones used to place the ORBITS 1s.

2.1.9 STAR STAND: Half of a flat cone, taped down that holds the STAR in the center of the BLACK HOLE.

2.1.10 RAMP (Referee Assisted Magic Platform): A structure that is used to dump the balls onto the STAR. The front support is 18" tall and is located 12" away from the outer edge BLACK HOLE.

2.1.11 AUTONOMOUS: The first 15 seconds of each match where robots run on preloaded code.

2.1.12 TELEOPERATED: The period of the match following autonomous during which robots are controlled by human drivers.

2.1.13 END GAME: The last 30 seconds of the match. The END GAME is a subset of TELEOPERATED.

2.2 Game Rules
2.2.1 Field Layout
2.2.1.1 The field is 8' x 12'. A wooden frame that is approximately 2.5" high and 0.75" thick forms the field wall.
2.2.1.2 The outer boundaries of the playing area are defined by the field wall.
2.2.1.3 The main surface of the playing area is "high-traffic" carpet that may have minor bumps and surface irregularities.
2.2.1.4 Robots will begin the match contained within the boundaries of their coalition's BASE. Teams will be designated to be on either the "Red" or "Blue" coalition on a match-by-match basis as noted on the match list.
2.2.1.5 STAR starts the match in the center of the BLACK HOLE supported by the STAR STAND.
2.2.1.6 All field dimensions should be considered to be +/- 0.5"

2.2.2 Match Timing
2.2.1 Each match will consist of an AUTONOMOUS period, TELEOPERATED period, and an END GAME period.
2.2.2 Referees will enter ORBs and ASTEROIDS to the field via the RAMP at the following predetermined times:
   2.2.2.1 ORBs: At the end of AUTONOMOUS
   2.2.2.2 ASTEROIDS: One (1) minute into TELEOPERATED, during the Driver Switch
2.2.3 Match Scoring

2.2.3.1 Scores will be calculated when all items on the field have come to rest.

2.2.3.2 An ORB or ASTEROID is considered scored in a BASE or ORBIT if it is contained within, and solely supported by the goal.

2.2.3.3 At the end of the match, scores will be calculated as follows:
   2.2.3.3.1 Each robot that is completely outside their coalition's BASE at the end of AUTONOMOUS: five (5) points.

2.2.3.3.2 ORBs scored in AUTONOMOUS:
   2.2.3.3.2.1 BASE: one (1) point
   2.2.3.3.2.2 ORBITS Level 1: two (2) points
   2.2.3.3.2.3 ORBITS Level 2: three (3) points
   2.2.3.3.2.4 ORBITS Level 3: five (5) points

2.2.3.3.3 Game pieces scored in TELEOPERATED
   2.2.3.3.3.1 ORB
      2.2.3.3.3.1.1 BASE: one (1) point
      2.2.3.3.3.1.2 ORBITS Level 1: two (2) points
      2.2.3.3.3.1.3 ORBITS Level 2: three (3) points
      2.2.3.3.3.1.4 ORBITS Level 3: five (5) points

   2.2.3.3.3.2 ASTEROID
      2.2.3.3.3.2.1 BASE: two (2) points
      2.2.3.3.3.2.2 ORBITS Level 1: eight (8) points
      2.2.3.3.3.2.3 ORBITS Level 2: twelve (12) points
      2.2.3.3.3.2.4 ORBITS Level 3: twenty (20) points

   2.2.3.3.3.3 If the STAR is scored on an ORBIT:
      2.2.3.3.3.3.1 The value of all ORBs and ASTEROIDS scored in that ORBIT is doubled.
      2.2.3.3.3.3.2 Five (5) points are added to that COALITION's score.

   2.2.3.3.3.4 Each robot supported only by the BLACK HOLE and / or STAR STAND: twenty five (25) points.

2.2.3.4 The winner of the match is the coalition that has the most points after the match has been scored.

2.2.4 Competition Structure

2.2.4.1 The competition will consist of Qualifying Matches followed by Elimination Matches.

2.2.4.2 Qualifying Matches
   2.2.4.2.1 All teams will play in the same number of Qualifying Matches. The number of qualifying matches at each event will be determined by the length of the event and the number of teams competing.
      2.2.4.2.1.1 For all teams to have an equal number of official matches, some teams may be required to play an extra match, known as a surrogate match. This match does not count in the official ranking of any surrogate teams participating. Surrogate matches will be indicated on the match list.

   2.2.4.2.2 Teams will be given their schedule of qualification matches no later than the start of the first match of that day's event.
2.2.4.2.3 Teams will be randomly assigned to coalitions during qualifying matches. The qualification match schedule will show the match number, the four teams competing in each match, and the color they are assigned for that match.

2.2.4.3 Ranking: At the end of the qualifying matches, teams will be ranked based on the following:

2.2.4.3.1 Greatest number of wins

2.2.4.3.2 If tied, the total sum of autonomous points

2.2.4.3.3 If tied, opposing coalition's average point score (before penalties)

2.2.4.3.4 If still tied, team's average point score (before penalties)

2.2.4.3.5 If still tied, opponent's average ranking

2.2.4.4 Elimination Matches

2.2.4.4.1 The number of coalitions participating in elimination matches will be no less than four, but may be increased prior to the start of the event based on the number of teams participating.

2.2.4.4.2 Coalition Drafting

2.2.4.4.2.1 At the conclusion of the qualifying matches, the top-ranked teams will be designated as Coalition Colonels. In order of their ranking, each Coalition Colonel will draft one team. An additional drafting round may take place at the discretion of the tournament director, increasing the number of teams per elimination coalition to three.

2.2.4.4.2.2 Coalition Colonels may not draft other teams designated as Coalition Colonels or those already drafted into service for other coalitions.

2.2.4.4.2.3 If a team declines the draft of any Coalition Colonel, they WILL NOT be allowed to play in the elimination matches.

2.2.4.4.3 During elimination matches, the #1 ranked coalition will play the lowest ranked coalition entering the elimination matches (i.e. if there are eight coalitions, #1 will play #8). The #2 coalition will play the second-to-lowest ranked coalition and so on.

2.2.4.4.4 Elimination matches will be a best 2-of-3 format.

2.2.4.4.5 Each coalition partner must play at least once during the first 2 matches of a best two-of-three round. If a robot becomes seriously damaged, the Coalition Colonel must inform the head referee immediately after the match in which the damage occurred. The head referee will then decide if the robot is exempt from this rule. The damaged robot must be re-inspected by the head referee before each best two-of-three round and must be re-declared inoperable in order to continue receiving the exemption.

2.2.5 Driver Rotation

2.2.5.1 During each match, teams will be required to switch their drivers halfway through the driver control period. There will be a ten-second (10) period during which the drivers must complete the switch or power will be shut off for the duration of the match.

2.2.5.2 Teams may choose to have another student operating other non-driving functions of the robot during the match. This optional position is not required to switch during a match.

2.2.5.3 Teams must have at least four different students to rotate through the driver position. In the event that fewer than four students attend the competition, teams must still place four students in the ordered list and forfeit the driving time of the missing student(s).

2.2.5.4 Four student participants of a team must drive their robot within the first two official matches in which the team places a robot on the field. Once the required number of team members have driven the robot, teams must continue switching drivers during their matches but any team member may come to the field to drive.
2.2.5.5 If it is known in advance that a student will be late to the event, please contact the tournament director at savage@wpi.edu as soon as possible to discuss possible alternatives.

2.2.6 Match Sequence
2.2.6.1 Each match is two (2) minutes and fifteen (15) seconds long
2.2.6.2 0-15 seconds - Robots enabled under Autonomous Control
2.2.6.3 15 seconds - Coalitions are awarded points scored in autonomous. ORBs dropped.
2.2.6.4 15-70 seconds - Robot under first Driver Control
2.2.6.5 70-80 seconds - Driver switch period. ASTEROIDS dropped.
2.2.6.6 80-135 seconds - Robot under second Driver Control
2.2.6.7 135 seconds - Match ends, robots disabled.

2.2.7 General Rules
2.2.7.1 All referee decisions regarding rules of play and judgments are final.
2.2.7.2 Repeated or intentional receiving of penalties will result in a disqualification.

2.2.7.3 Definitions
2.2.7.3.1 Pinning: A robot is considered pinned when it is being held against a field obstacle or another robot by a robot from an opposing coalition and cannot move in any direction. The closest referee will begin counting the pin from the moment the pin begins.
2.2.7.3.2 Penalty: Fifteen (15) points are added to the opposing coalition's score.
2.2.7.3.3 Disqualification: Robots may be disqualified based on their actions that violate the rules of the game. If a referee calls for a disqualification, the offending robot will receive a loss. The remaining members of both coalitions will receive their win/loss in qualification matches. If a team is disqualified during an elimination match, the coalition will receive a loss and the opposing coalition will receive a win.

2.2.7.4 Robot and Field Interaction Rules
2.2.7.4.1 Any ORB or ASTEROID that leaves the playing area during a match will be returned to the field by a referee via the RAMP. If the STAR leaves the playing field it will not be returned to the field.
2.2.7.4.2 Robots may NOT intentionally descore ORBs or ASTEROIDS from the ORBITS
2.2.7.4.2.1 If a team violates this rule, they will receive one penalty for each of the removed objects.
2.2.7.4.2.2 The removed objects will be returned to the respective scoring area, regardless of the intent of removing them.
2.2.7.4.3 Robots cannot possess the STAR, or remove the STAR from the STAR STAND outside of the END GAME. Each violation will earn the COALITION one penalty and the robot's coalition will not receive points or the multiplier for the STAR on any of their ORBITS. If the STAR is intentionally removed from the field, the offending team will receive 3 penalties.
2.2.7.4.4 During the END GAME, any robots partially inside the BLACK HOLE or interacting with a robot partially inside the BLACK HOLE Should expect vigorous interaction. Robots are allowed to and expected to move other robots out of the BLACK HOLE.
2.2.7.4.5 Robots may not intentionally tip an opposing team's robot. The tipping robot will be disqualified from the match if, in the referee's opinion, they initiated a lifting action that results in tipping. In incidents where the tipped robot initiates the action or both robots are in motion, the involved robots may be disabled.
2.2.7.4.6 Robots will be disabled for physically interacting with anything outside of the field.
2.2.7.4.7 If a robot is pinned for five seconds, the pinning team receives a penalty. An additional penalty will be applied every 5 seconds until the offending robot has moved at least 12" away from the pinned robot. Per rule 2.2.9.5, robots that accumulate multiple pinning penalties in a match are subject to immediate disqualification from the match.
2.2.7.4.8 All parts of the robot must remain attached to the robot for the duration of the match and must not cause any hazard of entanglement to the other robots. Any infraction of this rule may result in an immediate disqualification. Minor pieces that unintentionally become detached from the robot, do not affect the outcome of the match, or are the result of improper design/construction will not cause a disqualification.
2.2.7.4.9 Teams are allowed to modify their robots between matches as long as the robot remains compliant with all specifications and rules after the modification. Any significant modification should be brought to the attention of the referees or head inspector prior to the start of the team's next match. Teams may be subject to re-inspection at the discretion of the referees/head inspector. While teams are allowed to modify their robots between matches, multiple robots per team are not allowed.

2.2.8 Safety Rules
2.2.8.1 Team members may interact with their robot during a match only through the transmissions of the radio-controller. Only designated Drivers or Operators may be in contact with the controls during the match.
   2.2.8.1.1 Only team members who will be using the controls during the match will be allowed at the field. No coaches or human players are allowed at the field during a match.
   2.2.8.1.2 All team members who will be driving during the match must stay within their coalition station for the entirety of the match. Repeat violations of this rule may result in disqualification at the discretion of the referees.
   2.2.8.1.3 Teams must place their controls at a designated location before the beginning of the match. Team members may only touch these controls during driver control after the referees have signaled the start of driver control.
2.2.8.2 Team members may not extend any part of their body onto the field. Violations of this rule will lead to disqualification at the discretion of the referee.
2.2.8.3 Referees will disqualify any robot they deem to be a safety hazard.
2.2.8.4 Referees may request that teams alter any portion of their robots that are considered safety hazards or damaging to the playing field or scoring objects at any point during the competition. It is the right of the referees to prevent teams from playing in matches until such changes are made to the robot.
2.2.8.5 Damage to the playing field, the objects, or the control system may result in the disabling of the robot at the discretion of the referees. If the referee determines that further movement of the robot would result in field damage, it will be disabled.
2.2.8.6 Strategies aimed solely at the destruction of or damage to an opponent's robot or the field are not in the spirit of the competition and will not be allowed. This includes intentionally removing game objects from the field. Repeat violations of this rule may result in disqualification at the discretion of the referees.

2.2.9 All questions or request for rules clarifications should be submitted via email to savage@wpi.edu. Questions and answers will be publicly posted on the event website.

3. The Robot
3.1 Size Restriction
   3.1.1 At the start of each match, every part of the robot except for the flag holder (drinking straw, as specified in rule 3.4.4) must fit, unconstrained, in a stable position, within a box 15.25" by 15.25" by 18"
in any orientation. The robot must be fully self-supported, in contact only with the horizontal, carpeted (or taped) surface of the playing field.

3.2 Weight Restriction
3.2.1 Each robot's weight must not exceed 12.0 lbs.
3.2.2 The 12 lb. limit does not include the robot battery, the radio transmitter (i.e. the 75 MHz transmitter or VEXNet Joystick) or the color-designating flag.

3.3 Controls
3.3.1 Teams will each bring and provide their own controls to the competition. Crystals will be provided at the competition at the start of each match. Teams that use VEXNet must provide their own, known working VEXNet Keys.
3.3.2 Radio operation of the robots is not permitted in the pits. Teams should bring their phone cords/tethers for testing and operating in the pits. It is advisable that teams not bring their radio crystals to the competition.

3.4 Construction Rules
3.4.1 A robot must be designed to operate by reacting only against features within the confines of the playing field boundaries.
3.4.2 Gaining traction by use of adhesives or by abrading or breaking the surface of the playing field is not allowed and will be considered field damage and subject to disqualification.
3.4.3 Teams must have their assigned team number clearly marked on their robot such that it is visible from 15' away. The numbers should be at least 3" high, 3 Â¼" thickness and be on opposing sides of the robot. Team numbers will be assigned via the Savage Soccer website team list.
3.4.4 Teams must place a standard drinking straw, cut to 6" long, such that the straw is perpendicular to the ground on their robot. The top of the straw must extend above the top of the robot while in its starting configuration. This straw will have a colored flag inserted into the top to designate the coalition color. Prior to each match, teams must place the correct color flag on their robot, as indicated on the match list. Flags will be provided at the start of the match and must be removed from the robot before leaving the playing field. Multiple infractions of this rule may result in a disqualification at the discretion of the referees.
3.4.5 A robot may not intentionally contaminate the playing field or an opponent's robot with lubricants or other debris.
3.4.6 Robots may only be designed and built after the initial kickoff event.

3.5 Building Constraints
3.5.1 Each team will be expected to use parts only from the VEX Robotics System unless specified below.
3.5.2 Teams may NOT modify any of the VEX electronics or motors. Modification of items on the additional materials list is permitted.
3.5.3 Teams may use any 7.2V battery, up to approximately 3500 mAh. Only one battery may be used on the robot at a time.
3.5.4 Robots may only use publicly available VEX parts, found at http://www.vexrobotics.com/vex, and parts listed on the additional materials list. Robots may not use VEX IQ components, or VEX Pro parts that do not qualify under the additional materials list.
3.5.5 Robots may only use up to $50 of materials listed on the Additional Materials List. Robots that utilize materials from the Additional Materials list (see 3.6.2) must provide provide a Bill of Materials with the appropriate retail cost of each item.
3.5.6 Robots may use up to eight VEX motors, and an unlimited number of VEX servos.
3.5.7 Teams may purchase pneumatics kits, provided it is equivalent to any kits or portions thereof shown at http://www.vexrobotics.com/products/accessories/motion
3.6 Materials
3.6.1 Any amount of materials in the Additional Materials List will be allowed provided the total costs of all items on the robot is within the budget specified in 3.5.4 and it does not violate any other rules.

3.6.2 Additional Materials List
3.6.2.1 Plastic sheet, up to 0.25" thick
3.6.2.2 Aluminum or steel sheet, up to 0.125" thick
3.6.2.3 Any aluminum, steel, or plastic round shaft or tubing up to 0.5" diameter
3.6.2.4 Any bearings
3.6.2.5 Plywood or wood up to 0.5" thickness
3.6.2.6 "Foam rubber" or styrofoam like materials up to 0.75" thickness
3.6.2.7 Pizza Boxes, Cardboard or foam-board
3.6.2.8 String or twine
3.6.2.9 Any springs or elastic bands (must be designed to release energy no faster than it was input)
3.6.2.10 Fasteners, washers, adhesives, and tape
3.6.2.11 Lubricants used to reduce friction within parts of your robot
3.6.2.12 Non-functional decorations
3.6.2.13 Paper, plastic-wrap, aluminum foil, fabric or any paper or cloth-like material
3.6.2.14 Plastic 3D printed parts no bigger than a 3" in length width or height and all 3D printed parts must weigh less than 0.25lbs.
3.6.2.15 Any sensors

3.6.3 Materials that are not official VEX EDR materials, or are not listed as approved additional materials must be approved via email to savage@wpi.edu. Responses will be posted publicly. Robots that attend the competition with unapproved materials on their robot will not be given approval at the event and will not pass inspection until the offending materials have been removed.

3.7 Energy Sources
3.7.1 The energy used by the devices in the competition must come solely from:
3.7.1.1 A change in altitude of the center of gravity of the device
3.7.1.2 Energy stored by deformation of any approved materials.
3.7.1.3 Electrical energy delivered by the battery to the electronics and motors provided with the kit.
3.7.1.4 Pressure stored in the pneumatics system, not to exceed 100 psi.

3.8 Electronics
3.8.1 Teams must keep clear and easy access to their robot controller, specifically the power switch. The indicator lights on the front or top of the controller must also be clearly visible.
3.8.2 Teams must keep clear and easy access to the crystals in their robot receiver. Crystals will need to be exchanged quickly prior to each match. Inspectors or referees may request a team move the receiver to provide easier access before they are allowed to play.
3.8.3 Prior to each match, teams using the PIC (old) controller will receive a crystal set from the Field Captain. The crystals must be returned before the team leaves the field at the end of the match.
3.8.3.1 Multiple infractions of 3.8.3 may lead to a disqualification at the discretion of the head referee.
3.8.4 All teams are required to program their robot such that the robot will start and stop while under the control of a standard VEX field control system. The event is able to offer on-site support to teams using
an appropriate easyC Template. Specifically, VEX Net or Cortex robots must use a WIFI template, while PIC robots must use a timed competition template with a 15 second autonomous mode and a 254 second operator control mode. Teams will not pass inspection unless they are able to demonstrate their robots can be enabled and disabled by the field.