Lawrence Technological University

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LAWRENCE TECHNOLOGICAL UNIVERSITY ROBOFEST

BOTTLESumo

Autonomous robots compete to push bottles and each other off of the table

V 2.0 – Updated Version for 2026 Season

This file can be found on the **BottleSumo** page on the website
Coaches are responsible for communicating rules updates to participants

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Room J233 Taubman Complex, LTU 21000 West 10 Mile Road, Southfield, MI 48075, USA

1. BottleSumo Overview (1/2)

Learning Objectives:

- STEAM subjects including physics
- Autonomous navigation
- Computer programming logic
- Edge detection
- Object detection
- Autonomous search algorithms
- Adjusting to environmental conditions
- Problem solving

Synopsis:

- **An Open Category** competition, which will take place at the World Robofest Championship
- Local events may host BottleSumo, but there are no qualifying competitions. (Teams must re-register for World Championship event)
- The objective of BottleSumo to be the last robot remaining on the table

1. BottleSumo Overview (2/2)

- BottleSumo competition has two sessions:
  - Time Trial - to rank robots based off pushing bottles and seed a tournament bracket. 20% of teams presented with award trophies
  - Single Elimination Tournament - with “head to head” games and no bottles. 2 teams presented with award trophies (1st and 2nd Place)
- Definitions:
  - Game: a single head to head round
  - Match: a series of two or more games to determine which team advances in the tournament
  - Match Winner: the first team to win two games

2. Age Divisions, Team Size and Fees

- Three Divisions
  - Junior Classic Division (Grades 5-8)
  - Junior Unlimited Division (Grades 5-8) **(New for 2026!)**
  - Senior Classic Division (Grades 9-12)
  - Senior Unlimited Division (Grades 9-12)
- Team Size: Maximum three (3) members
- Team Registration Fee:
  - $100 at the World Championship (Registration fee at local event may be different)
- Teams must review and abide by: Robofest 2026 General Rules
- Each team member must bring the signed Robofest Consent and Release Form on the day of the event, if not completed online

3.1 Robot Requirements (1/3)

- Robots must be created by students. If a team is identified to have a robot too similar to another robot (including robots from the same organization and both Jr and Sr divisions) or clearly not their own, team will be subject to investigation (design and code interviews) and possible robot changes, penalties, or disqualification
- Robot must be fully constructed upon arrival to the competition
- Robot must be fully autonomous. No human control, signal, or remote computer control (tele-op)
- One robot per team (same robot must be used for entire tournament)
- Labeling requirements:
  - Robofest Team ID on any visible surface – (Team Name optional)
  - “Front” indicator on the side with sensors, which must remain the same throughout the tournament
- Teams will need to bring a laptop computer to modify their programs to adjust for conditions on competition day

3.1 Robot Requirements (2/3)

	Junior Classic	Senior Classic	Junior Unlimited	Senior Unlimited
Maximum robot weight	1.2 Kg	1.5 Kg	2.5 Kg	3 Kg
Maximum robot width, length, and height	Must fit in **21x21x21**cm box. Robots may **NOT** expand their dimensions beyond this maximum	Must fit in **30x30x30**cm box. Robots may **NOT** expand their dimensions beyond this maximum	Must fit in **30x30x30**cm box. Robots may **NOT** expand their dimensions beyond this maximum	
Number of robot brains	One brain only	Any number	Any number	
Robot brain limits	LEGO NXT, LEGO EV3, LEGO SPIKE Prime/Robot Inventor, VEX IQ (Gen 1 or Gen 2 only)		Any	
Robot battery limits	Voltage is limited to <= 9.0v		No limit	
Wheels, treads, or legs (the parts driven by motors which touch the ground)	Must be standard, unmodified LEGO or VEX IQ parts. Vacuum or sticky material **NOT** allowed		Vacuum or sticky material **NOT** allowed	
Robot Shape	Ramps not allowed. Front, rear, and sides of robot (outer envelope of the robot, 25mm or lower from the ground) cannot be sloped or horizontal. Motors must be visible so they can be inspected			

3.1 Robot Requirements (3/3)

	Junior Classic	Senior Classic	Junior Unlimited	Senior Unlimited
Sensor requirements	At least one sensor that can detect dark/light contrast on the plane of the table AND at least one sensor that can detect objects in front			
Number of sensors	Maximum 4 (Sensor Multiplexer* **NOT** allowed)		Unlimited (Sensor Multiplexers* ALLOWED)	
Sensor types**	LEGO or VEX IQ Sensors, must use standard wires		Any, unless harmful to humans	
On-board vision sensor system	**NOT** allowed		Examples of allowed vision sensors: Pixycam smart phone vision	
Number of motors	Maximum 3		Unlimited	
Motor types**	• LEGO NXT, LEGO EV3, LEGO SPIKE Prime or VEX IQ. • Voltage altering over default voltage is **NOT** allowed • Other motors such as LEGO Power Function and EV3 medium motors **NOT** allowed		Any type	
Materials	LEGO or VEX IQ parts only		Any materials. You may use tape, glue, rubber bands, etc. to construct the robot	
Programming language	Any			

- *Multiplexer allows the use of one port for multiple sensor channels
- **See Section 3.2 for list of allowable motors and sensors for Jr Classic and Sr Classic

3.2 Allowable Parts: Jr Classic and Sr Classic

Platform	Motors	Sensors
LEGO SPIKE Prime	LEGO SPIKE Prime (45602,45603)	LEGO Technic Distance Sensor 45604 LEGO Technic Color Sensor 37308 LEGO Technic Force Sensor 37312
LEGO EV3	LEGO EV3 (455202) LEGO NXT (9842)	LEGO EV3 Color Sensor 45506 LEGO EV3 Ultrasonic Sensor 45504 LEGO EV3 Infrared Sensor 45509 LEGO EV3 Gyro Sensor 45504 LEGO EV3 Touch Sensor 45507 LEGO NXT Light Sensor 55969 LEGO NXT Ultrasonic Sensor 53792 LEGO NXT Color Sensor 64892 LEGO NXT Touch Sensor 53793
LEGO NXT		
VEX IQ	VEX IQ (228-2560)	VEX IQ Color Sensor 228-3012 VEX IQ Optical Sensor 228-7082 VEX IQ Distance Sensor (Gen 1) 228-3011 VEX IQ Distance Sensor (Gen 2) 228-7106 VEX IQ Touch Sensor 228-2677 VEX IQ Gyro Sensor 228-3014 VEX IQ TouchLED 228-3010

3.3 Special World Championship Rules

- Jr Classic and Sr Classic teams must use motors issued by Robofest for the competition. Teams will exchange their team motors for Robofest issued motors before worktime
- Teams will use the worktime to reassemble their robots. Motors will be exchanged back after the tournament.
- The first worktime will be increased to 30 minutes. Teams must be able to change out the motors and be ready by the end of the work time.

4. BottleSumo Playing Fields (1/2)

Junior and Senior Divisions: Made up of one table

Common Set up for Head to Head rounds

4. BottleSumo Playing Fields (2/2)

- Competition tables are 30in x72in (actual size is about 75cm x 182cm) plastic folding tables
- The recommended brand is “Lifetime” which can be found at https://www.lifetime.com/lifetime-2901g-6-foot-folding-table-commercial
- The four corners of the table are rounded
- The radius of the corner circle is 4cm ~ 7cm
- Table thickness is about 4.5cm
- Table surface is light in color, for example, almond, tan, or gray
- Exact size, color, brightness, and edge shape are unknown until the day of the competition

Raised Table Setup for all Divisions

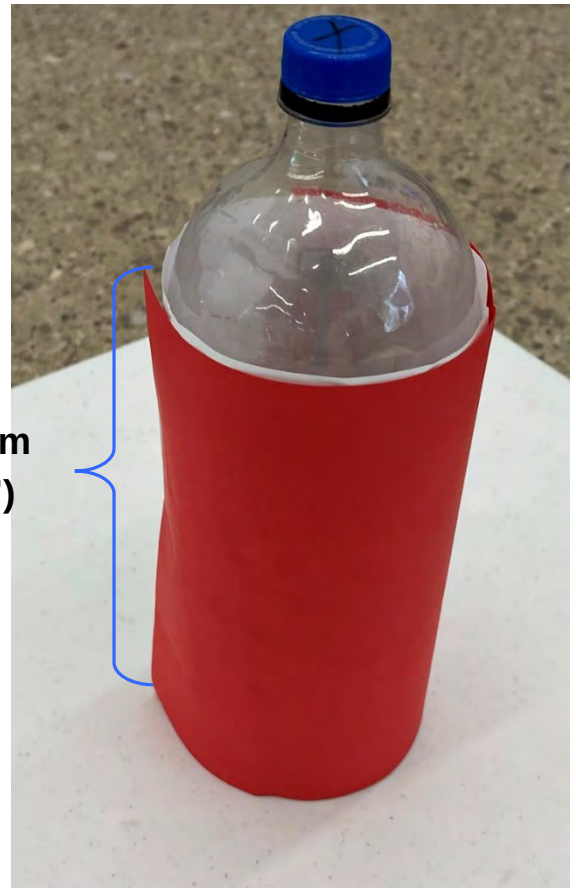
- The table is placed on a dark colored floor with the legs folded under and raised up with rolls of packing tape (a stack of three recommended)

5. Bottle Specification: Used For Time Trials

- A two-liter bottle covered with red paper (8.5in x 14in, may take 2 pieces of paper)
- The exact color of the red paper is unknown until the competition day
- Bottle is filled with 1 kg of sand
- FOR LOCAL EVENTS:
  - If the two-liter bottle shown right is not available, a slimmer bottle may be modified by using materials like yoga mats or sponge sheets

  OR

  - Thinner bottles may also be used without modification



Bottle Dimensions

6. Robot Start Task

- Robots must have a 3-second delay before moving
- The 3-second delay is required for the Time Trials and the Head to Head matches
- All values must be preprogrammed before the impound ends. After impound, on-field calibration and adjustments (using buttons, switches, etc.) are NOT allowed.
- Robots must be started the same way (same button, switch, etc.) for each time trial and game
- Any preset motion must be the same for each game (for example: robot initially turns left 90 degrees or robot turns left until object detected)

7. Competition Procedures

- Only participants are allowed to access the pit area, team tables, practice fields and official game fields throughout the competition day including: setup time before opening ceremony, work time, and breaks
- Immediately after the opening ceremony, a 15 minute (30 min for World Championship) timer will start for teams to make final adjustments to their robots
- After the work period, all the robots will be inspected and then impounded
- During impound, the robot will be inspected for size, weight, and labels. Judges will also inspect the robot for any illegal materials and document the program (name/slot number) that will be used and the method of starting the robot
- Battery charging is not allowed in impound
- Participants should not pick up their robot until instructed by a Judge

8.1 Time Trial Round Rules (1/2)

A. At the start of each Time Trial, the Judge will announce (a) the location of the robot (b) orientation of the robot. The same location/orientation will be used for all time trials during an event
B. Teams will place their robots on the field according to the Judge's instructions
C. The bottle locations for the Time Trial will be announced after impound. The same bottle arrangement will be used for all teams during an event
D. Judge will measure the time taken for each robot (one per table) to push 5 bottles off the table
E. Time will be recorded to 1/100 of a second, starting from zero
F. Maximum time given is 2 minutes (120 seconds)
G. If a robot falls off the table or does not knock off all the bottles, survival time and number of bottles pushed off the table will be recorded. (See examples in section #9.2)
H. Robot must remain intact and on the table for at least 3 seconds after any bottle is pushed off or it will be penalized. The 3 seconds is not included in the recorded time.

8.1 Time Trial Round Rules (2/2)

I. Time will be measured until one of the following occurs:
   1. The fifth bottle is knocked off “Completion Time”
   2. The robot falls off the table (Survival Time)
   3. The robot stays on the table but is still running at the 2 minute mark (“120 sec Survival Time”)

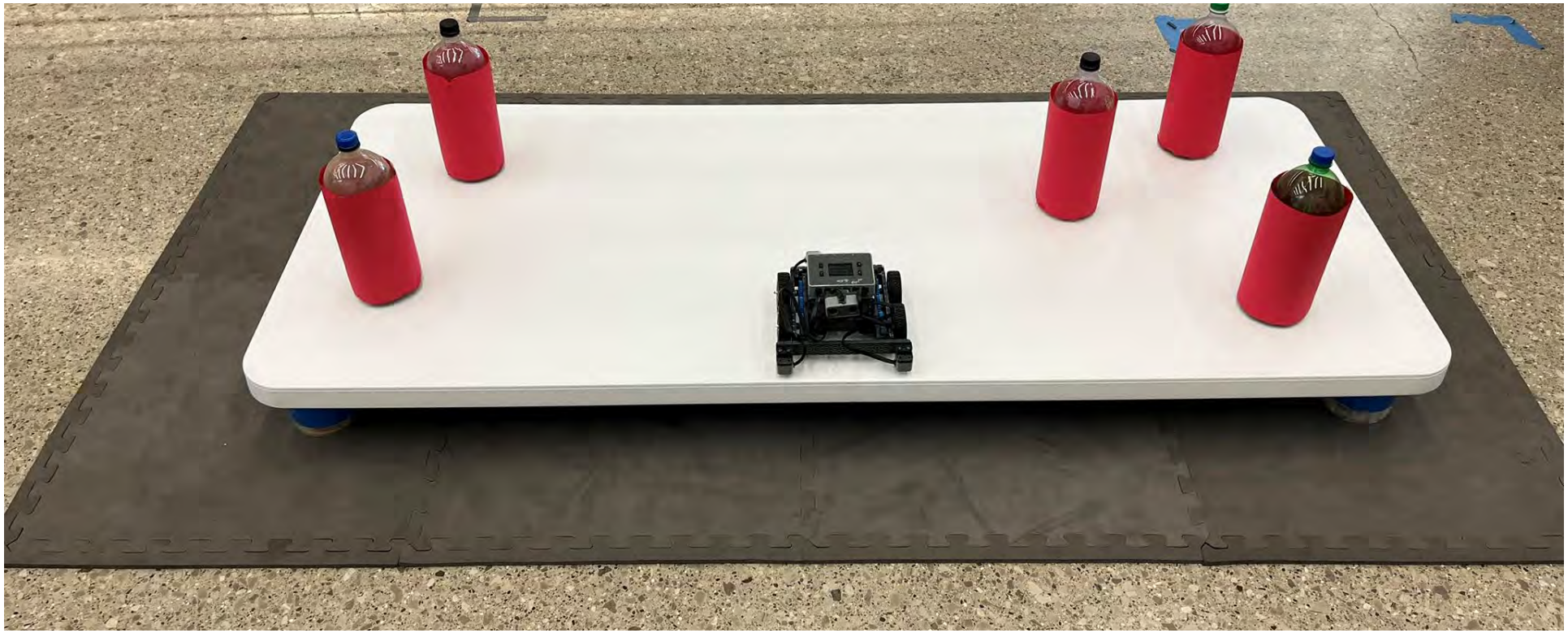
J. After all teams have completed the Time Trial, teams will have an additional 15 minutes to modify robot or program

K. During this time, a single elimination seeded tournament bracket will be created based on the rankings from the Time Trials. (http://www.printyourbrackets.com)

L. Teams will be seeded (ranked) based on the following:
   1. Start Task completion
   2. Number of bottles
   3. Staying on the table for at least 3 seconds after pushing any bottle off
   4. Completion Time or Survival Time

M. Time Trial calculations will be managed in the Time Trial Scoresheet: https://www.robofest.net/images/2526/BottleSumo2026TTScoresheet.xlsx

8.2 Example Time Trial Set Up



Bottle locations are unknown (announced after impound). The same bottle arrangement will be used for all teams during an event

9.1 Time Trial Score Card

https://www.robofest.net/images/2526/BottleSumo2026TTScorecard.pdf

BottleSumo Time Trial Score Card	ROBOFEST
Division (circle one) Jr Cl Jr UL Sr Cl Sr UL	Team ID _____ Team Name _____
3 second Delayed Start was Correct?	Y N
Number of Bottles pushed off	0 1 2 3 4 5
Did the robot stay on the table for 3 sec after last bottle?	Y N
CHECK ONE BELOW ___**Completion Time** (if all bottles off and robot on table; do not include 3 sec after bottle off) **OR** ___**Survival time** (if bottles left or robot falls off table)	**Record Elapsed Time (from Zero)**
Judge's Initials	_____
Team Member's Initials	_____

9.2 Time Trial Ranking Example

LAWRENCE TECHNOLOGICAL UNIVERSITY ROBOFEST (Location) BOTTLESumo

Rank	Team ID	Description	Start Task Correct?	Number of Bottles Pushed Off?	3 sec after last bottle?	Completion Time (elapsed) Robot pushes off all bottles	Survival Time (elapsed) Robot off table or bottles left	Comments
1	6	Last bottle off at 50s (50s completion time)	Y	5	Y	50		All bottles off, ranked by completion time
2	5	Last bottle off at 60s (60s completion time)	Y	5	Y	60		All bottles off, ranked by completion time
3	7	Last bottle off at 100.5s (100.5s completion time)	Y	5	Y	100.5		All bottles off, ranked by completion time
4	11	Last bottle off at 120s, Robot falls off at 122s	Y	5	N		122	All bottles off, but did not survive for 3 sec, ranked by survival time
5	2	Last bottle off at 118s Robot falls off table at 119s	Y	5	N		119	All bottles off, but did not survive for 3 sec, ranked by survival time
6	3	Robot survives on table at the end; One bottle on table	Y	4	Y		120	4 bottles off, ranked by 3 sec rule then survival time
7	8	Robot falls off at 30s; One bottle on table	Y	4	Y		30	4 bottles off, ranked by 3 sec rule then survival time
8	4	Robot survives on table at the end; Two bottles on table	Y	3	Y		120	3 bottles off, ranked by 3 sec rule then survival time
9	13	Robot survives on table at the end; Three bottles on table	Y	2	Y		120	2 bottles off, ranked by 3 sec rule then survival time
10	14	Robot survives on table at the end; Four bottles on table	Y	1	Y		120	1 bottles off, ranked by 3 sec rule then survival time
11	16	Robot falls off at 110s; Four bottles on table	Y	1	Y		110	1 bottles off, ranked by 3 sec rule then survival time
12	15	Robot falls off at 115; Four bottles on table; did not survive 3 sec	Y	1	N		115	1 bottles off, ranked by 3 sec rule then survival time
13	10	Robot falls off table at 10s; 5 bottles on table (10s survival time)	Y	0	Y		10	0 bottles off, but did not stop, ranked by 3 sec rule then survival time
14	1	Failed Start task; Judge stops round	N	0	Y		0	Only robot to fail start task, last place

(*) Note that Team 16 was ranked ahead of Team 15 because Team 15 did not survive 3 sec after the bottle fell off

10. Game (Head to Head) Rules: Two Robots/No Bottles

A. A maximum of 2 minutes is given for each game
B. At the start of each game, the Judge will announce (a) the location of the robots (b) orientation of the robots. Location and orientation may be different for each game
C. Teams will place their robots on the field according to the Judge's instructions
D. The robot must have a 3-second delay before moving
E. If the robot fails to move, the robot automatically loses the game, unless the other robot also fails to move, in which case it is a tie
F. If the robot fails 3-second delay requirement, the robot automatically loses the game, unless the other robot also fails the 3-second delay requirement, in which case it is a tie
G. After the start, students/Judges must move at least 1 meter away from the table edges until after the end of the game
H. If any piece/part of the robot comes off the robot, and subsequently falls on the floor, the opposing robot will be IMMEDIATELY declared the winner of the game
I. One battery change and one Pneumatics refill are allowed during the head to head matches

11. Determining the Winner of a Game

- A robot is declared the winner of a game if one of the following criteria is met:
  - The robot satisfies the start requirement and the opponent fails the start requirement
  - It pushes the opponent off the table and then remains intact and on the table for at least 3 seconds
  - It remains intact and on the table for at least 3 seconds after the opponent has fallen off the table
  - If the result is unclear, the game will be declared a tie (see instructions for match ties on page 20)
- NOTE: Judge must use a timing device such as the display timer, cell phone app, or stopwatch to insure time requirement has been met before declaring a winner

12. Game Rules - Ties

- A tie game will be declared if the judge determines that:
  - Both robots at the same moment have any of their parts touch the floor (except in the case of a piece of the robot falling on the floor, See section 10 rule H)
  - The robots both fall off the table within three seconds of each other
  - NO progress is being made for 20 seconds at Judge's discretion
  - BOTH robots fail to start (do not move)
  - BOTH robots fail the Start requirement
  - One robot fails to start (does not move) and the other robot fails the Start requirement
  - There is no winner after two minutes
  - The result is unclear or too close to call
- If after 3 games the match is a tie, then the tie breakers will be (1) the time trial result (2) up to 2 additional games if time trial result is tied (3) tie-breaker time trial with one bottle.
- The Judge will use his/her discretion to make any decisions for the situations not documented in these rules. Judges have the right to disqualify teams that break rules or are not following the judge's instructions. The Judges' rulings are final

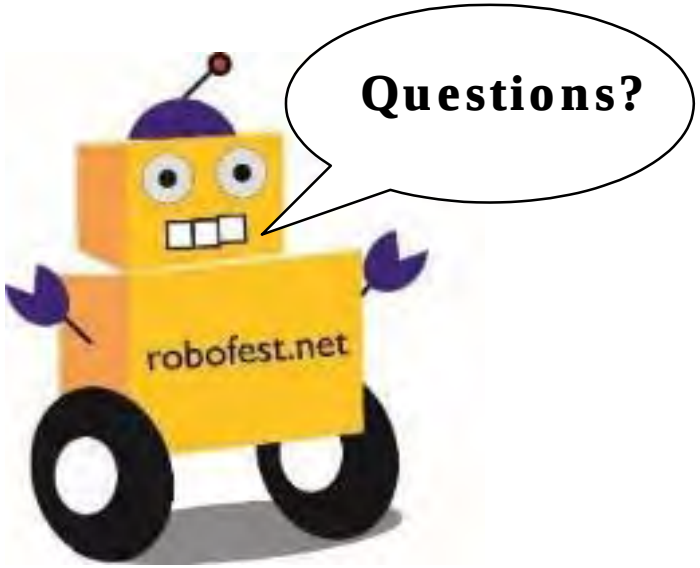
13. FAQ (Frequently Asked Questions) (1/2)

- Can a robot have multiple programs to select from when a game starts? No, the robot must use the same program and start the same way for each game.
- If robot A pushes robot B off the table, but A fell off the table too before the 3 seconds. Who is the winner? Tie Game.
- Robot A failed the start requirement. Robot B was successful and survived on the table at least 3 seconds. B is the winner.
- Both robots failed the start requirement. Tie Game.
- My start button was not pressed correctly. Can I touch the robot after the game started? No in general, but up to the Judge's discretion.
- Do VEX IQ Touch LEDs count as sensors (for Jr and Sr Classic sensor limits)? If the Touch LED is used as an output (light) it will not count against the 4 sensor limit. However, it will count if used as a touch sensor.

13. FAQ (Frequently Asked Questions) (2/2)

- For the time trial, does the robot need to stop after the last bottle is off? No, time will be measured when the last bottle hits the ground.
- Are pneumatics and flywheels allowed? Yes, in all divisions.
- Will there be an unknown start at the competitions or at the World Championship? No, all competitions will use a 3 sec delay start this season
- Can a robot expand if it stays within the size limit after expansion? Yes, robots may expand or change dimensions during a game as long as they remain within the maximum size allowed.

Little Robots, Big Missions



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Priya Boopalan
David Carbery P.E.
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Chris Parker

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