2017/2018 Robot Game Rules

Guiding Principles

GP1 - *GRACIOUS PROFESSIONALISM*®
You are *"Gracious Professionals."* You compete hard against **problems**, while treating **all people** with respect and kindness. If you joined *FIRST* LEGO League with a main goal of "winning a Robotics competition," you're in the wrong place!

GP2 - INTERPRETATION
- **If a detail isn't mentioned, then it doesn't matter**.
- Robot Game text means exactly and only what it plainly says.
- If a word isn't given a game definition, use its common conversational meaning.

GP3 - BENEFIT OF THE DOUBT - If the Referee (Ref) feels something is a "very tough call," and no one can point to strong text in any particular direction, you get the **Benefit Of The Doubt**. This good-faith courtesy is not to be used as a strategy.

GP4 - VARIABILITY - Our suppliers and volunteers try hard to make all Fields correct and identical, but you should always expect little defects and differences. Top teams design with these in mind. Examples include Border Wall splinters, lighting changes, and Field Mat wrinkles.

GP5 - INFORMATION SUPERIORITY - If two official facts disagree, or confuse you when read together, here's the order of their authority (with #1 being the strongest):

#1 = Current Robot Game **UPDATES**

#2 = **MISSIONS** and **FIELD SETUP**

#3 = **RULES**

#4 = **LOCAL HEAD REF** - In unclear situations, local Head Referees may make good-faith decisions after discussion, with Rule GP3 in mind.

- Pictures and video have no authority, except when talked about in #1, #2, or #3.
- Emails and Forum comments have no authority.

Definitions

D01 - MATCH - A "Match" is when two teams play opposite each other on two Fields placed north to north.
- Your Robot LAUNCHES one or more times from Base and tries as many Missions as possible.
- Matches last 2-1/2 minutes, and the timer never pauses.

D02 - MISSION - A "Mission" is an opportunity for the Robot to earn points. Missions are written in the form of requirements.
- Most requirements are **RESULTS** that must be visible to the Ref at the **END OF THE MATCH**.
- Some requirements are **METHODS** that must be observed by the Ref **AS THEY HAPPEN**.

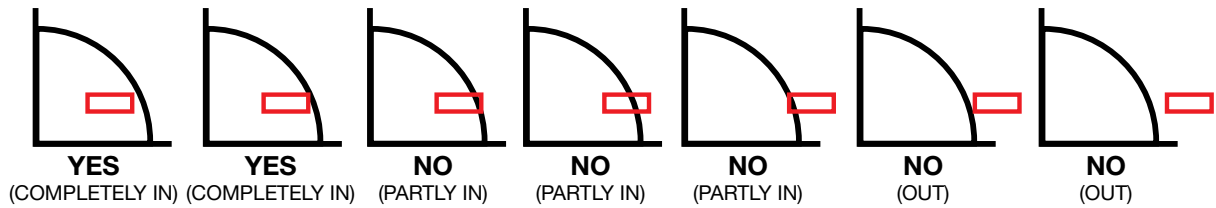**D03 - EQUIPMENT** - "Equipment" is everything **YOU BRING** to a Match for Mission-related activity.

D04 - ROBOT - Your "Robot" is your LEGO MINDSTORMS controller and all the Equipment you've combined with it by hand which is not intended to separate from it, except by hand.

D05 - MISSION MODEL - A "Mission Model" is any LEGO element or structure **ALREADY AT THE FIELD** when you get there.

D06 - FIELD - The "Field" is the Robot's game environment, consisting of Mission Models on a Mat, surrounded by Border Walls, all on a Table. "Base" is part of the Field. For full details, see FIELD SETUP. Download the Field Setup Guide at www.firstlegoleague.org/challenge.

D07 - BASE - "Base" is the space directly above the Field's quarter-circle region, in the south-west. It extends southwest from the curved line TO the corner walls (no farther). The diagrams below define **"COMPLETELY IN"** for Base, but apply for **ANY** area.

YES	**YES**	**NO**	**NO**	**NO**	**NO**	**NO**
(COMPLETELY IN)	(COMPLETELY IN)	(PARTLY IN)	(PARTLY IN)	(PARTLY IN)	(OUT)	(OUT)

D08 - LAUNCH - Whenever you're done handling the Robot and then you make it GO, that's a "Launch."

D09 - INTERRUPTION - The next time you interact with the Robot after Launching it, that's an "Interruption."

D10 - TRANSPORTED - When a thing **(anything)** is purposefully/strategically being…
- taken from its place, and/or
- moved to a new place, and/or
- being released in a new place,

it is being "Transported." The process of being Transported ends when the thing being transported is no longer in contact with whatever was transporting it.

Equipment, Software and People

R01 - ALL EQUIPMENT - All Equipment must be made of LEGO-made building parts in original factory condition.
Except: LEGO string and tubing may be cut shorter.
Except: Program reminders on paper are okay (off the Field).
Except: Marker may be used in hidden areas for identification.

R02 - CONTROLLERS - You are allowed only ONE individual controller in any particular Match.
- It must exactly match a type shown below (**Except:** Color).
- ALL other controllers must be left in the PIT AREA for that Match.
- All remote control or data exchange with Robots (including Bluetooth) in the competition area is illegal.
- This rule limits you to only ONE individual ROBOT in any particular Match.

EV3	NXT	RCX

R03 - MOTORS - You are allowed up to FOUR individual motors in any particular Match.
- Each one must exactly match a type shown below.
- You may include more than one of a type, but again, your grand total may not be greater than FOUR.
- ALL other motors must be left in the PIT AREA for that Match, NO EXCEPTIONS.

EV3 "LARGE"	EV3 "MEDIUM"	NXT	RCX

R04 - EXTERNAL SENSORS - Use as many external sensors as you like.
- Each one must exactly match a type shown below.
- You may include more than one of each type.

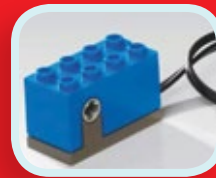| EV3 TOUCH | EV3 COLOR | EV3 ULTRASONIC | EV3 GYRO/ANGLE |
| NXT TOUCH | NXT LIGHT | NXT COLOR | NXT ULTRASONIC |
| RCX TOUCH | RCX LIGHT | RCX ROTATION | |

R05 - OTHER ELECTRIC/ELECTRONIC THINGS - No other electric/electronic things are allowed in the competition area for Mission-related activity.
Except: LEGO wires and converter cables are allowed as needed.
Except: Allowable power sources are ONE controller's power pack or SIX AA batteries.

R06 - NON-ELECTRIC ELEMENTS - Use as many non-electric LEGO-made elements as you like, from any set.
Except: Factory-made wind-up/pull-back "motors" are not allowed.
Except: Additional/duplicate Mission Models are not allowed.

R07 - SOFTWARE - The Robot may only be programmed using LEGO MINDSTORMS RCX, NXT, EV3, or RoboLab software (any release). No other software is allowed. Patches, add-ons, and new versions of the allowable software from the manufacturers (LEGO and National Instruments) are allowed, but tool kits, including the LabVIEW tool kit, are not allowed.

R08 - TECHNICIANS
- Only two team members, called "Technicians," are allowed at the competition Field at once.
  Except: Others may step in for true emergency repairs during the Match, then step away.
- The rest of the team must stand back as directed by tournament officials, with the expectation of fresh Technicians being able to switch places with current Technicians at any time if desired.

R09 - BEFORE THE MATCH TIMER STARTS
- After getting to the Field on time, you have at least one minute to prepare. During this special time only, you may also...
- ask the Ref to be sure a Mission Model or setup is correct, and/or
- calibrate light/color sensors anywhere you like.

R10 - HANDLING DURING THE MATCH
- You are not allowed to interact with any part of the Field that's not COMPLETELY in Base.
Except: You may Interrupt the Robot any time.
Except: You may pick up Equipment that BROKE off the Robot UNINTENTIONALLY, anywhere, any time.
- You are not allowed to cause anything to move or extend over the Base line, even partly.
Except: Of course, you may <u>LAUNCH</u> the Robot.
Except: You may move/handle/<u>STORE</u> things off the Field, any time.
Except: If something accidentally crosses the Base line, just calmly take it back - no problem.
- Anything the Robot affects (good or bad!) or puts completely outside Base **stays as is** unless the Robot changes it. Nothing is ever repositioned so you can "try again."

R11 - MISSION MODEL HANDLING
- You are not allowed to take Mission Models apart, even temporarily.
- If you combine a Mission Model with something (including the Robot), the combination must be loose enough that if asked to do so, you could pick the Mission Model up and nothing else would come with it.

R12 - STORAGE
- Anything completely in Base may be moved/stored off the Field, but must stay in view of the Ref, on a stand.
- Everything in off-Field Storage "counts" as being completely in Base.

R13 - LAUNCHING
- A proper Launch (or re-Launch) goes like this:

- READY SITUATION
  o Your Robot and everything in Base it's about to move or use is arranged by hand as you like, all fitting **"COMPLETELY IN BASE"** and measuring no taller than 12 inches" (30.5 cm).
  o The Ref can see that nothing on the Field is moving or being handled.

- GO!
  o Reach down and touch a button or signal a sensor to activate a program.

FIRST LAUNCH OF THE MATCH – Here, accurate fair timing is needed, so the exact time to Launch is the beginning of the last word/sound in the countdown, such as "Ready, set, GO!" or BEEEEP!

R14 - INTERRUPTING
- If you **INTERRUPT** the Robot, you must stop it immediately, *then calmly pick it up for a re-Launch (*if you intend one). Here's what happens to the Robot and anything it was Transporting, depending on where each was at the time:

- **ROBOT**

o Completely in Base:	Re-Launch
o NOT completely in Base:	Re-Launch + Penalty

- **TRANSPORTED THING**

o Completely in Base:	Keep it
o NOT completely in Base:	Give it to the Ref

The <u>"PENALTY"</u> is described with the <u>MISSIONS</u>.

R15 - STRANDING
- If the **UNINTERRUPTED** Robot loses something it was Transporting, that thing must be allowed to come to rest. Once it does, here's what happens to that thing, depending on its rest location:

- **TRANSPORTED THING**

o Completely in Base:	Keep it
o Partly in Base:	Give it to the Ref
o Completely outside Base:	Leave as is

R16 - INTERFERENCE

- You are not allowed to negatively affect the other team except as described in a Mission.
- Missions the other team tries but fails because of illegal action by you or your Robot will count for them.

R17 - FIELD DAMAGE

- If the Robot separates Dual Lock or breaks a Mission Model, Missions obviously made possible or easier by this damage or the action that caused it do not score.

R18 - END OF THE MATCH - As the Match ends, everything must be preserved exactly as-is.

- If your Robot is moving, stop it ASAP and leave it in place. (Changes after the end don't count.)
- After that, hands off everything until after the Ref has given the okay to reset the table.

R19 - SCORING

- SCORESHEET - The Ref discusses what happened and inspects the Field with you, Mission by Mission.
  o If you agree with everything, you sign the sheet, and the scoresheet is final.
  o If you don't agree with something, the Head Ref makes the final decision.
- IMPACT - Only your BEST score from regular Match play counts toward awards/advancement. Playoffs, if held, are just for extra fun.
- TIES - Ties are broken using 2nd, then 3rd best scores. If still not settled, tournament officials decide what to do.

CHANGES FOR 2017

- The word "objects" has been replaced with the word "things" for parallelism with the term "anything."
- Definition of "Transporting" is opened up for situations not directly involving the Robot.
- Maximum Equipment height UPON LAUNCH is now limited.

2017/2018 Robot Game Missions
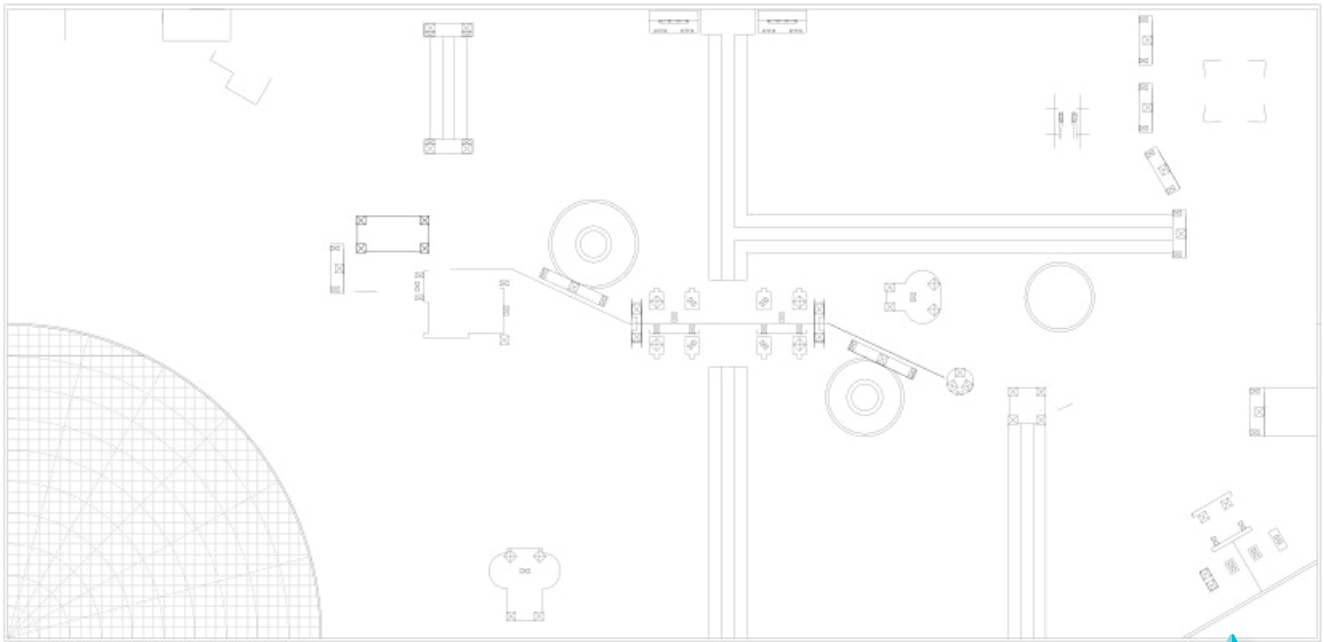
M01 - PIPE REMOVAL
Move the Broken Pipe so it is completely in Base.
20 Points

SCORE

M04 - RAIN
Make at least one Rain come out of the Rain Cloud.
20 Points
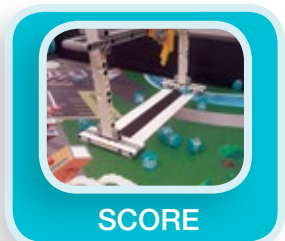
SCORE

M02 - FLOW
*Move a Big Water (one time maximum) to the other team's field *only by turning the Pump System's valve(s).
25 Points

SCORE

M05 - FILTER
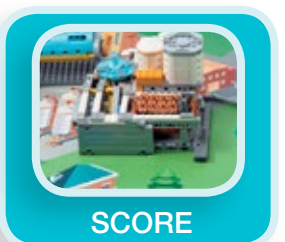Move the Filter north until the lock latch drops.
30 Points

SCORE

M03 - PUMP ADDITION
Move the Pump Addition so it has contact with the mat and that contact is completely in the Pump Addition target. **20 Points**

SCORE

M06 - WATER TREATMENT
Make the Water Treatment model eject its Big Water, *only by moving the Toilet's lever.
20 Points

SCORE

M07 - FOUNTAIN

Make the Fountain's middle layer rise <u>some obvious height and stay there, due only to a Big Water in the gray tub</u>. **20 Points**
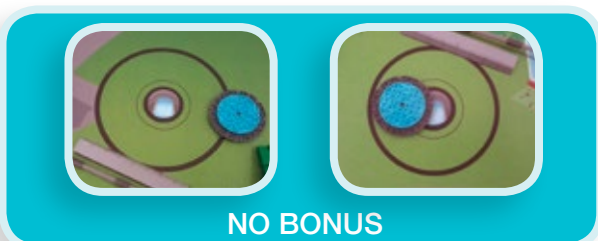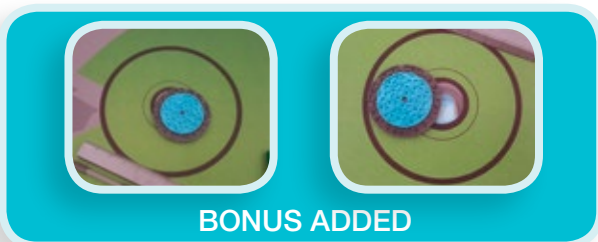

NO
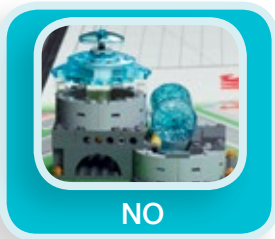
SCORE

M08 - MANHOLE COVERS

Flip Manhole cover(s) <u>over, obviously past vertical</u> *without it/them ever reaching Base. **15 Points** EACH

Each cover is scored individually.
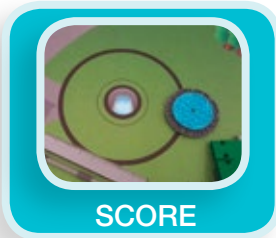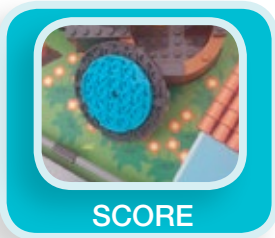
SCORE

SCORE

FOR BONUS: Score 30 Manhole Cover points as described above. WITH <u>both covers completely in separate Tripod targets</u>. **30 Points Added**

BONUS ADDED

NO BONUS

M09 - TRIPOD

Move the inspection camera Tripod so it is FOR PARTIAL SCORE: <u>partly in either Tripod target, with all of its feet touching the mat</u>. **15 Points**
FOR FULL SCORE: <u>completely in either Tripod target, with all of its feet touching the mat</u>. **20 Points**

FULL

PARTIAL

PARTIAL

NO
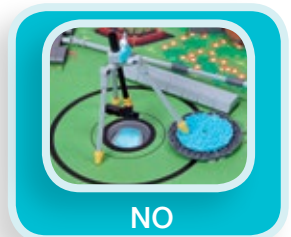
M10 - PIPE REPLACEMENT (Install the Optional Loop first, in Base, if you wish.)

Move a New Pipe so it is <u>where the broken one started, in full/flat contact with the mat</u>. **20 Points**


"FULL /FLAT CONTACT"

SCORE

SCORE

NO

M11 - PIPE CONSTRUCTION (Install the Optional Loop first, in Base, if you wish.)
Move a New Pipe so it is

FOR PARTIAL SCORE: <u>partly in its target, in full/flat contact with the mat.</u> **15 Points**
FOR FULL SCORE: <u>completely in its target, in full/flat contact with the mat.</u> **20 Points**
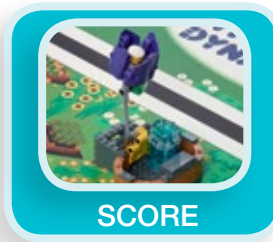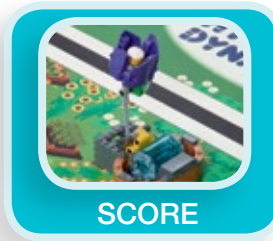

NO

PARTIAL

FULL
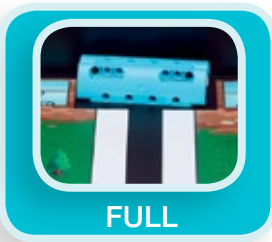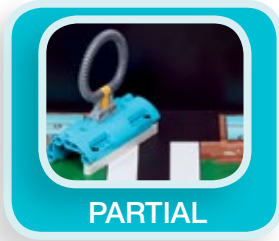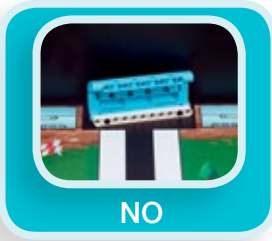
M12 - SLUDGE
Move the Sludge so it is <u>touching the visible wood of any of the six drawn garden boxes</u>. **30 Points**

SCORE

SCORE

NO
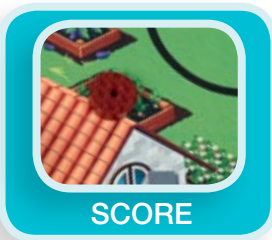
M13 - FLOWER
Make the Flower rise <u>some obvious height and stay there, due only to a Big Water in the brown pot</u>. **30 Points**

SCORE

SCORE

SCORE

BONUS ADDED

FOR BONUS: Score Flower Points as described above WITH <u>at least one Rain in the purple part, touching nothing but the Flower model</u>. **30 Points Added**

M14 - WATER WELL
Move the Water Well so it has <u>contact with the mat and that contact is</u>
FOR PARTIAL SCORE: <u>partly in the Water Well target</u>. **15 Points**
FOR FULL SCORE: <u>completely in the Water Well target</u>. **25 Points**

FULL

FULL

PARTIAL

M15 - FIRE
Make the <u>fire drop</u> *only by making the Firetruck apply direct force to the House's lever. **25 Points**

SCORE

M16 - WATER COLLECTION
Move or catch Big Water and/or Rain water (one Rain maximum; no Dirty Water) so it is <u>touching the mat in the Water Target</u>, *without the target ever reaching the white Off-Limits Line shown below. Water may be touching the target, and/or other water, <u>but not be touching nor guided by anything else</u>. Each water model is scored as an individual.

At least one Rain: **10 Points**   Big Water: **10 Points EACH**

OFF-LIMITS LINE EXTENDS ALL THE WAY NORTH/SOUTH INCLUDING UNDER RAMPS	NO SCORE	SCORE: TWO BIG WATER AND AT LEAST ONE RAIN	NO SCORE	SCORE: AT LEAST ONE RAIN
SCORE: TWO BIG WATER	SCORE: ONE BIG WATER	SCORE: AT LEAST ONE RAIN	SCORE: TWO BIG WATER	

FOR BONUS: Score at least one Big Water in its target as described above WITH <u>one on top, which is touching nothing but other water</u>. **30 Points (Maximum only one Bonus can score)**

BONUS ADDED	BONUS ADDED	NO BONUS	NO BONUS

M17 - SLINGSHOT

Move the SlingShot so it is <u>completely in its target</u>. **20 Points**

SCORE

SCORE

NO
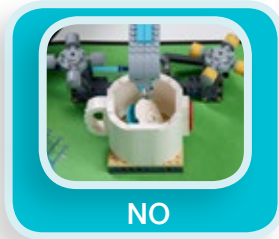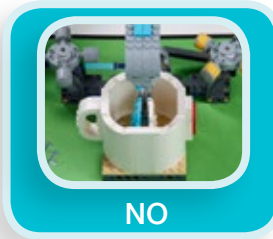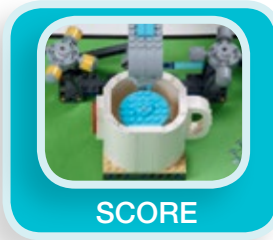
FOR BONUS: Score SlingShot points as described above WITH the Dirty Water and a Rain <u>completely in the SlingShot target</u>.
15 Points Added

BONUS ADDED

BONUS ADDED

M18 - FAUCET

Make the water level <u>obviously more blue than white as seen from above the cup</u>, *only by turning the Faucet handle. **25 Points**

SCORE

SCORE

NO

NO

PENALTIES - Before the match starts, the Ref removes the six red Penalty discs from the Field, and holds on to them. If you Interrupt the Robot, the Ref places one of the removed Samples in the white triangle, in the southeast, as a permanent/untouchable Interruption Penalty. You can get up to six such penalties, worth -5 Points EACH

Robot Design Executive Summary

An "executive summary" is often used by engineers to briefly outline the key elements of a product or project. The purpose of the Robot Design Executive Summary (RDES) is to give the Robot Design Judges a quick overview of your team's robot and all that it can do.

Some regions require all teams to prepare a Robot Design Executive Summary, while others do not. Either way, the RDES is a great tool to help your team organize their thoughts about the robot and the design process they used. Check with your tournament organizer to see if your team is expected to present your RDES in the Robot Design judging session.

Unlike the Core Values Poster, teams do not need to create a poster or written material for the RDES. However, if the team would like to share pictures of the design process, records of strategy sessions, or examples of programming (either printed or on a laptop), the RDES presentation is an appropriate time.

Have your team prepare a short presentation (no longer than four (4) minutes) covering the elements below:

1. **Robot Facts:** Share a little bit about your robot, such as the number and type of sensors, drivetrain details, number of parts and the number of attachments. The Judges also like to know what programming language your team used, the number of programs, and the Robot Game mission where your team had the most success.

2. **Design Details:**

   a. Fun: Describe the most fun or interesting part of robot design as well as the most challenging parts. If your team has a fun story about your robot please feel free to share.

   b. **Strategy**: Explain your team's strategy and reasoning for choosing and accomplishing missions. Talk a little bit about how successful the robot was in completing the missions that were chosen.

   c. **Design Process:** Describe how your team designed their robot and what process they used to make improvements to the design over time. Briefly share how different team members contributed to the design.

   d. **Mechanical Design:** Explain the robot's basic structure. Explain to the Judges how the robot moves (drivetrain), what attachments and mechanisms it uses to operate or complete missions, and how your team makes sure it is easy to add/remove attachments.

   e. **Programming:** Describe how your team programmed the robot to ensure consistent results. Explain how the team organized and documented programs. Mention if the programs use sensors to know the location of the robot on the field.

   f. **Innovation:** Describe any features of the robot's design that the team feels are special or clever.

3. **Trial Run:** Run the robot briefly to demonstrate how it completes the mission(s) of your team's choice. Please do not do an entire robot round. The Judges need time to ask questions after the RDES.

Want to learn more?

- Find the essential details of the Robot Game in the Challenge: www.firstlegoleague.org/challenge.
- Check the Robot Game Updates often: www.firstlegoleague.org/challenge. Here *FIRST*® LEGO® League staff will clarify common questions. Updates supersede anything in this Challenge document and will be in effect at tournaments.
- Your team will be assessed in the judging room using a standard rubric. Review the Robot Design judging information and rubric: www.firstlegoleague.org/challenge.
- Your team will also compete in at least three Robot Performance matches. Learn more about Robot Performance, how to approach the Robot Game with your team, and tips from experienced Coaches in the Coaches' Handbook: www.firstlegoleague.org/challenge.
- If you are completely new, check out the *FIRST* LEGO League Resource page for videos, tips, and additional helpful rookie links: www.firstlegoleague.org/challenge.

Notes

http://www.firstlegoleague.org
http://www.firstinspires.org

200 BEDFORD STREET ▪ MANCHESTER, NH 03101 USA
(800) 871-8326

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