

# Missions and Rules for 2009 Smart Move FLL Competition

## ■ Robot Game Overview

The Smart Move Robot Game gives you first-hand experience in getting a sensor-equipped vehicle (your robot) to **gain access to places and things**, while **avoiding or surviving impacts**, all in a test environment...

Imagine if you could program a vehicle to take you places, or even go by itself...

Imagine if each vehicle knew where all the other ones were...

Imagine if vehicles could avoid each other and the things around them...

Imagine if vehicles could be programmed to avoid causing or driving into traffic jams...

Would traffic signals be needed any more?

If these vehicles did hit each other...

How might they be built to really keep passengers safe?

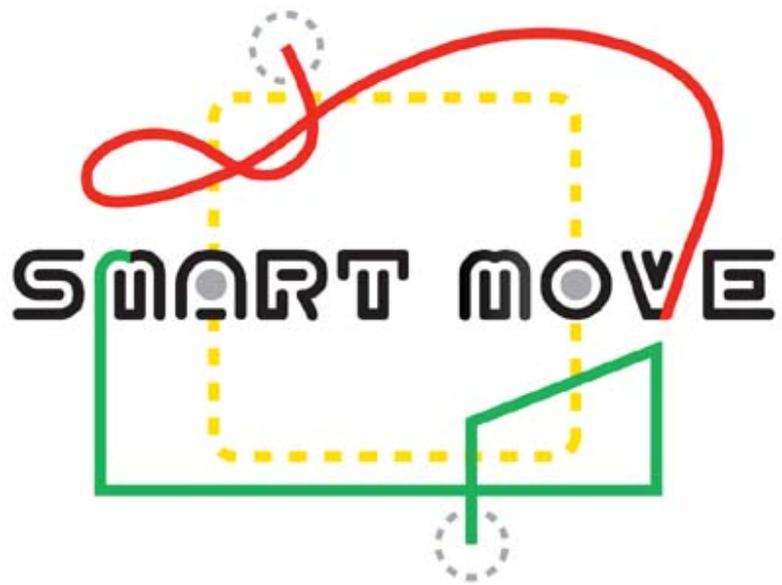
How might they be built to avoid getting stuck or damaged?

Have you noticed that most vehicles near where you live are only used part of the day?

How might the number of vehicles in your area be reduced?

What new technologies could sometimes eliminate your need to travel?

Now in addition to imagining and wondering... Try some of this yourself!



# Missions and Rules for 2009 Smart Move FLL Competition

## IMPORTANT FLL DOCUMENTS...

Follow the information from each of these document sources:

Field Setup

Rules

Missions

Q&A

Don't make assumptions based on what the rules were in previous seasons!

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## COMPLETE *FIRST* LEGO LEAGUE EXPERIENCE:

It is easy to get so wrapped up in the robot design and implementation that the actual scoring criteria are lost. Remember that in judging, the robot's performance counts for only 25% of your team's score. Equally important is the presentation of your research project (25%) and your technical presentation (25%) to the judges, as well as your demonstrated teamwork (25%)!

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## SMART MOVE FIELD INTRODUCTION...

MISSIONS:



## Missions and Rules for 2009 Smart Move FLL Competition

**MISSION: GAIN ACCESS TO PLACES (choose one)...** Required Condition: Your vehicle needs to be in one of these positions exactly as the match ends (this mission does not affect others):

**TARGET SPOT** - Required Condition: Parked with its drive wheels or treads touching the round target.

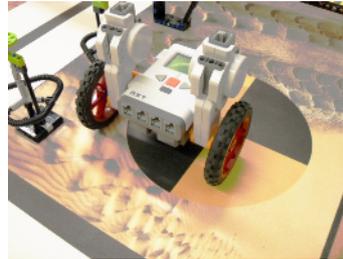
Value: 25 points.



Before



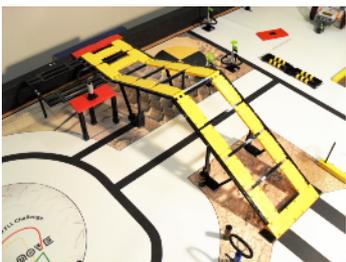
Scoring Example



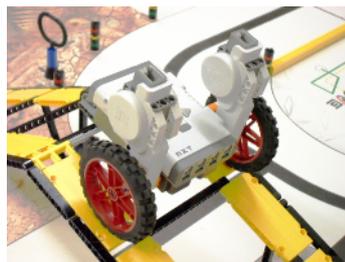
Scoring Example

**YELLOW BRIDGE DECK** - Required Condition: Parked with its drive wheels or treads touching your yellow bridge decking, but not touching any red decking or the mat.

Value: 20 points.



Before



Scoring Example

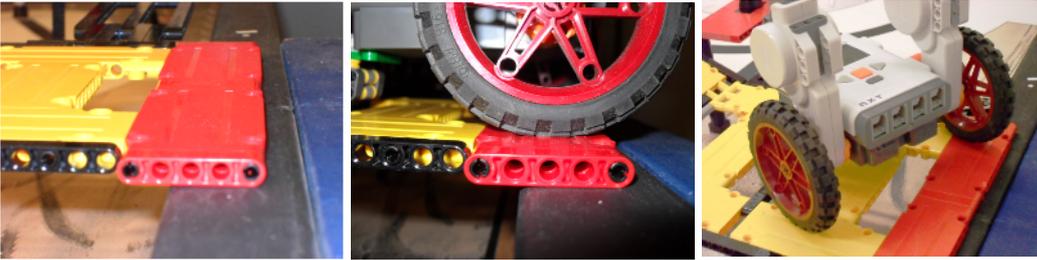


Scoring Example

**VEHICLE SHARING** - Required Condition: Parked with its drive wheels or treads touching your red bridge decking, but not touching the mat.

Value: 25 points.

# Missions and Rules for 2009 Smart Move FLL Competition



Before

Scoring Example

Scoring Example



## MISSION: GAIN ACCESS TO THINGS...

**ACCESS MARKERS** - Required Condition: Access markers need to be in their "down" position.

Value: 25 points each.



Before

Scoring Example

Scoring Example

# Missions and Rules for 2009 Smart Move FLL Competition

## MISSIONS:



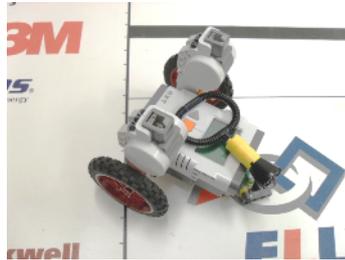
## MISSION: GAIN ACCESS TO THINGS...

**LOOPS** - Required Condition: Loops need to be in Base.

Value: 10 points each.



Before



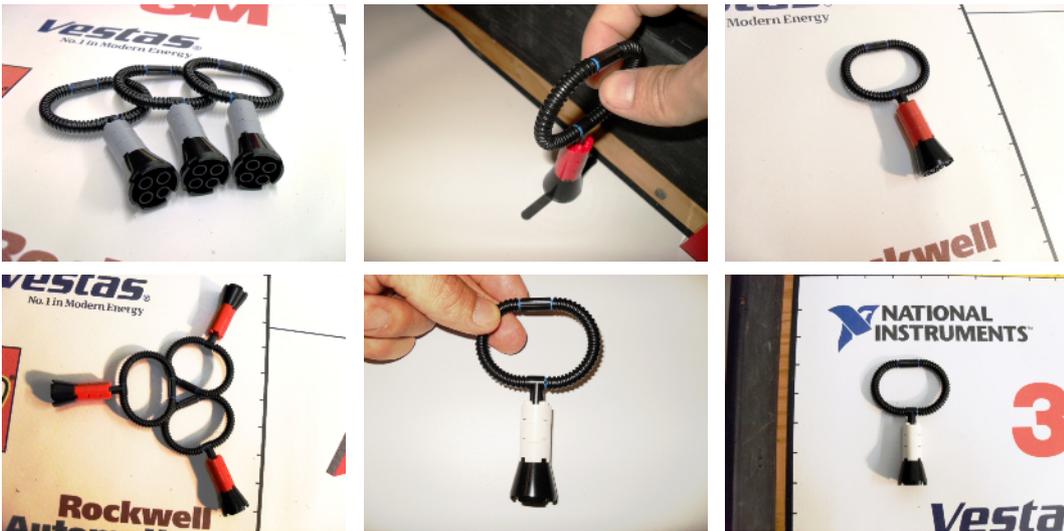
Scoring Example



Scoring Example

**BONUS:** New technologies can sometimes eliminate your need to travel. They are hard to develop, but each new one makes the next come easier... If all three gray loops have reached Base, you may take one red loop into Base by hand. Independent from that, if all three red loops have reached Base, you may take one loop of any color into Base by hand. Once earned, these hand freedoms (which are a special exception to the rules) may be used any time before the match ends.

## Missions and Rules for 2009 Smart Move FLL Competition



### MISSION: AVOID IMPACTS...

**WARNING BEACONS** - Required Condition: Warning beacons need to be upright (square to the mat).

Value: 10 points each.

ALSO: Warning beacons are the touch penalty objects for the Smart Move Robot Game. This means each time you touch your vehicle while it's completely out of Base, the referee removes one upright beacon. The beacons are removed in order from south to north, then from west to east. If there are no upright beacons at the time of the touch, there is no penalty.

# Missions and Rules for 2009 Smart Move FLL Competition



Before

Scoring Example

Scoring Example



## MISSION: AVOID IMPACTS...

**SENSOR WALLS (AVOIDANCE OPTION):** Required Condition: Sensor walls need to be upright (square to the mat). Any four walls can count. Only four walls can count. Each upright sensor wall also requires a "down" access marker. Example: If there are four upright walls but only three access markers down, only three walls count.

Value: 10 points each, max 40.



Before

Scoring Example

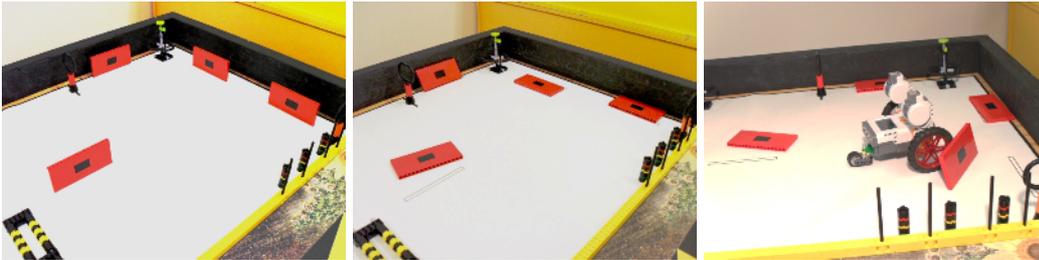
Scoring Example

## Missions and Rules for 2009 Smart Move FLL Competition

### MISSION: SURVIVE IMPACTS...

**SENSOR WALLS (IMPACT OPTION):** Required Condition: No (zero) sensor walls are upright.

Value: 40 points.



Before

Scoring Example

Scoring Example

### MISSIONS:



### MISSION: SURVIVE IMPACTS...

**VEHICLE IMPACT TEST:** Required Condition: The truck needs to no longer touch the ramp's red stopper beam. Your entire vehicle needs to be completely out of Base when it produces the required condition, otherwise the referee removes two upright warning beacons (in the same manner as two touch penalties).

Value: 20 points.

## Missions and Rules for 2009 Smart Move FLL Competition



Before

Scoring Example

Scoring Example



### MISSION: SURVIVE IMPACTS...

**SINGLE PASSENGER RESTRAINT TEST:** Required Conditions: The crash-test figure needs to be aboard your vehicle for the entire match. The first time your vehicle is without the figure, the referee removes the figure. Any constraint system is okay as long as the figure can be separated quickly after the match.

Value: 15 points.



Before

Scoring Example

Scoring Example

# Missions and Rules for 2009 Smart Move FLL Competition

MISSIONS:



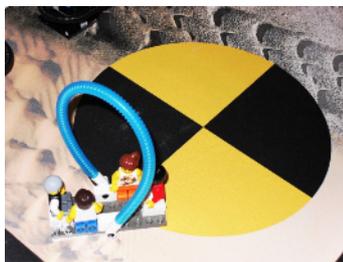
## MISSION: SURVIVE IMPACTS...

**MULTIPLE PASSENGER SAFETY TEST:** Required Condition: All four people are sitting or standing in or on a transport device of your design, and some portion of that object is in the round target area.

Value: 10 points.



Before



Scoring Example



Scoring Example

MISSIONS:



# Missions and Rules for 2009 Smart Move FLL Competition

## ■ Gracious Professionalism

You are “Gracious Professionals.” This means you are competing hard against PROBLEMS, while treating PEOPLE with respect and kindness - people from your own team as well people from other teams.

You build onto other people’s ideas instead of resisting or defeating them.

Read more about [Gracious Professionalism](#)

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## ■ Purpose

Interest in engineering innovation...

FLL is a technical experience so fun, you forget it’s technical. Soon you realize technical *is* fun - and want more.

FLL uses competition as an exciting motivator to get you to come up with ideas, solutions, processes, and inventions no one has ever seen before.

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## ■ Autonomy

The FLL Robot Game is to be played by an “autonomous” robot. That means you’re not supposed to influence it while it’s doing its work.

But most teams need to intercept their robot once or more during the match. So you’re allowed to do that, but it always forces a restart from Base, and sometimes, there’s a penalty.

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## ■ If A Detail Isn’t Mentioned, Then It Doesn’t Matter

Assuming you have read all the missions, rules, and Game Q&A carefully...

If no particular method is required, then any method is okay.

If something is not specifically required, then you don’t have to do it.

If there’s no restriction against something, then it’s allowed.

There are no hidden requirements or restrictions.

But there are hidden freedoms - in what the rules do *not* say.

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# Missions and Rules for 2009 Smart Move FLL Competition

## 1 - Participation

The maximum allowable team size is ten members, not including coaches and mentors.

See the *FIRST LEGO League Coaches' Handbook* for allowable ages.

At the tournament, only two team members at a time are allowed right up at the competition table except during repair emergencies.

The rest of the team must stay back from the table, but close enough for different members to tag in or out as desired at any time. Specific positioning is decided by the head officials running each tournament.

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## 2 - Parts

This rule is not only about the robot. It also covers all of the attachments and strategic objects you bring to the competition area...

Everything you compete with must be made of LEGO elements in original factory condition, except LEGO string and tubing, which you may cut to length. Exception: You can reference a paper list to keep track of programs.

There are no restrictions on the quantities or sources of non-electric LEGO elements, except that factory-made wind-up/pull-back "motors" are not allowed. Pneumatics are allowed.

The electric elements used must be the LEGO MINDSTORMS type, and the total number of electric elements you may use in one match is limited as follows:

### For RCX users:

RCX controller (1)

motors (3)

touch sensors (2)

light sensors (2)

lamp (1)

rotation sensors (3)

3<sup>rd</sup> touch OR light sensor  
(1)

### For NXT users:

NXT controller (1)

motors (3)

touch sensors (2)

light sensors (2)

lamp (1)

rotation sensors (3 minus the number of NXT  
motors present)

ultrasonic sensor (1)

Example 1: If your robot has three motors, you may not have any other motor in the competition area, even if it's only for weight or decoration; even if it's in a box, off the field.

Example 2: If your robot has two motors, but you have multiple attachments to motorize, you must design a way to switch the 3<sup>rd</sup> motor from one attachment to the next.

## **Missions and Rules for 2009 Smart Move FLL Competition**

LEGO wires and converter cables are allowed as needed.

Spare/alternate electrical parts are allowed in the pit area.

Computers are not allowed in the competition area.

Objects functioning as remote controls are not allowed anywhere.

Marker may be used for owner identification in hidden areas only.

Paint, tape, glue, oil, etc. are not allowed.

Stickers are not allowed except LEGO stickers applied per LEGO instructions.

You are not allowed to use more than one robot in a single match, but it's okay to use a different robot in a different match.

If a robot is in violation - of this rule or the SOFTWARE rule - and cannot be corrected, the decision about exactly what to do rests with the head officials at the tournament, but that robot may not win awards.

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### **3 - Software**

Your robot must be programmed using LEGO MINDSTORMS, RoboLab, or NXT software (any release).

Patches, add-ons, and new versions of the allowable software from the manufacturers (LEGO and National Instruments) are allowed.

Text-based and/or "outside" software is not allowed.

The point of this rule is the same as that of the MATERIALS rule: Since we can't ensure equal coaching for all teams, we at least limit this unfairness by capping the power of the tools.

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### **4 - Downloading And Wireless Signals**

Downloading programs to robots must take place in the pits only - never in the competition area.

Teams downloading to an RCX robot must make sure the process is shielded, that there are no other RCX robots in range, and robots should be turned off when not in use.

Teams downloading to an NXT robot must do so by cable. Bluetooth must be switched off at all times.

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### **5 - Field**

The field is where the Robot Game takes place.

It consists of a field mat, on a table, with mission models arranged on top.

The field mat and the LEGO pieces for building the mission models are part of your Field Setup Kit.

The instructions for building the mission models are on a CD which comes in the same box as the LEGO pieces.

# Missions and Rules for 2009 Smart Move FLL Competition

All other field setup instructions are on the Field Setup page.

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## 6 - Base

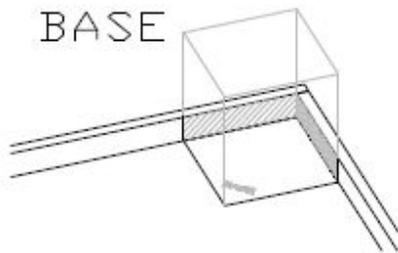
Base is a VOLUME. Base is not just an area on the mat.

Base is an imaginary box formed by vertical walls that rise from the perimeter of the Base area, including the inside surface of the border walls, and by an invisible ceiling 16 in (40 cm) high.

Base is where your robot is prepared and handled.

Base is where your robot always starts and restarts from.

Base is often a scoring target.



## 7 - Variability

As you build and program, keep in mind that our suppliers, donors, and volunteers make every effort to ensure that all fields are correct and identical, but you should always expect some variability, such as:

- flaws in the border walls.

- variety in lighting conditions.

- texture/bumps under the mat.

- waviness in the mat itself - at many tournaments, it is impossible for the mats to be rolled out in time to lose their waviness. Location and severity of waviness varies. You are being warned here. Consider this while designing.

Two important building techniques you can use to limit the effects of variability are:

- Avoid steering systems that involve something sliding on the mat.

- Cover your light sensors from surrounding light.

Questions about conditions at a particular tournament should be asked of that event's head officials.

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## 8 - Mission

A mission is defined as a result or action worth points.

## Missions and Rules for 2009 Smart Move FLL Competition

You decide the order you want to try missions in, and you don't have to try them all. You're allowed to re-try them, but often it's not possible.

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### 9 - Match

At a tournament, two Robot Game fields are joined back to back, and you are paired opposite another team to compete in a match. Here's the process:

You arrive at the competition table and have at least one minute to prepare your robot.

The match starts and you start your robot. Once started, the robot is now "active" and is understood to be working on missions.

The robot may get a lot done, or a little, but eventually you are likely to need/want to handle it. For example, it may become stuck, or you may want to add an attachment, or unload some cargo.

As soon as you touch it, no matter where it is or what it was doing, it is now "inactive" and must be carried to Base if it's not already there.

While the robot is in Base, you prepare it for its next active period, and restart it. These steps repeat (often with music, an announcer, and cheering in the background!), until the 2-1/2 minute match timer sounds (the timer never pauses during a match).

There are at least three matches at each tournament, and each one is a fresh chance for you to get your best score.

No match has anything to do with another, and only your best score counts specifically toward the Robot Performance Award.

If it is known in advance that a team will not have another team opposite them, a volunteer or "house" team should substitute. If you compete against an empty table, you get the points for any interactive missions.

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### 10 - Round

The process of cycling all teams through one match each is called a round.

Tournaments run at least three rounds.

Between your match in one round and the next, you usually have time to go to the pit area and work on your robot and its programs as needed, but this time may be limited, depending on the schedule of other proceedings.

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### 11 - Robot

Your robot is defined as the main body containing the NXT (or RCX) controller and anything that does not fall off when the main body is picked up, turned over (or flipped any way), and/or shaken.

# Missions and Rules for 2009 Smart Move FLL Competition

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## 12 - Attachments

Attachments are defined as parts of your robot that are designed to be added and/or removed.

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## 13 - Strategic Objects

Strategic objects are defined as team-supplied objects which you or your robot may use as tools or aids.

**You** may touch or use strategic objects \*only in Base, but **your robot** may touch or use them anywhere.

\*Example: If you're using a device to aim your robot, you need to either pull the device away or let go of it before your robot is allowed to start.

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## 14 - Mission Models

Mission models are defined as the objects that are already on a competition field when you walk up to it.

You may not bring duplicate mission models to the table if they could confuse scoring.

You may not take mission models apart, even temporarily.

Mission models must be separated from your team-supplied objects quickly after the match.

Be very careful not to leave the competition area with that field's mission models.

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## 15 - Housekeeping

After the referee (the "ref") inspects everything you've brought to the competition area, you may store it in Base and/or in a box on a stand where you can get to it quickly while operating your robot.

Team members other than the two at the table are not allowed to hold anything unless approved by the ref.

Nothing is allowed on the floor unless approved by the ref.

Mission models always need to stay in view of the ref.

In rare situations of crowding at Base, the ref allows you to store objects on the table away from Base, but only if it is obvious their placement is purely for storage.

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# Missions and Rules for 2009 Smart Move FLL Competition

## 16 - Robot Preparation and Handling

Before the match, and whenever else your robot is inactive, you are allowed to handle it and prepare it by hand for its next active period.

Typical preparations include repairs, switching attachments, loading and unloading objects, selecting programs, resetting features, and manipulating, arranging, and aiming the robot and any objects it will be moving or using.

This work should be done in or near Base to avoid messing up the field.

Once your robot and its objects are ready to start, the last thing you must do is to let go of it all.

## 17 - Muscle Actions

You may not cause things to extend, leave, or be placed out of Base, even partially, except as described in the START PROCEDURE and HOUSEKEEPING RULES.

You may not move or “adjust” anything outside of Base.

In Base, you are allowed to manipulate any objects that have reached Base, even to produce scoring conditions.

You may place objects completely in Base for an active robot to interact with, but only if you have obviously let go of them before your robot touches them.

As soon as your robot or anything it’s strategically controlling reaches Base, you may take it all (robot plus objects) into Base.

Dropping something on your active robot is treated as an active robot touch.

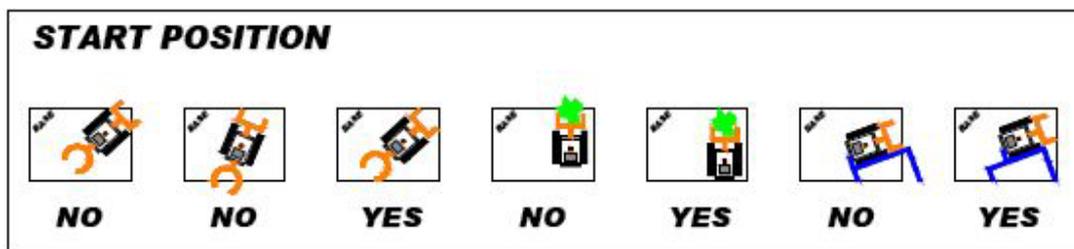
## 18 - Start Position

For all starts beginning and during the match, every bit of your robot including its attachments and any objects it is about to move or use must fit completely in Base. Nothing is allowed to be poking through the imaginary box.

Your robot is allowed, but not required, to touch objects it is about to move or use.

You must not be touching your robot or anything it is about to move or use.

Everything must be motionless.



# Missions and Rules for 2009 Smart Move FLL Competition

## 19 - Start Procedure

When it's obvious to the ref that starting position is correct...

For the start of the match...

The ref asks you if you're ready, then signal your readiness to the announcer.

As the countdown starts, you reach in with one hand, ready to either touch a button, or signal a sensor, to start or resume your robot's program.

When you hear the sound, you start your robot.

For all other starts (restarts)...

There's no countdown. The ref sees that you're ready, and you start your robot.

You may not handle your robot, or anything it's about to move or use, during or after the countdown. If you do, the ref has you restart. The point of this rule is to ensure that your only influence on your robot is to get its program running.

The exact time to start is at the beginning of the last word in the countdown, such as "Ready, set, GO!"

If a different signal is used, the start is at the beginning of that signal.

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## 20 - Active Robot <> Inactive Robot

At the moment your robot is started, it becomes "active" and remains so until the next time you touch it, or anything it is strategically controlling.

At the moment of that touch, the robot becomes inactive again, and must be carried to Base unless it's already there. There may be additional \*\*consequences.

The inactive robot in Base may then be handled/prepared and restarted.

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## 21 - Active Robot Touched COMPLETELY Out Of Base

If the robot **and every object** in its strategic control are **completely out** of Base...

a "touch penalty object" is taken out of play if one is available, as described in the missions.

objects that were with the robot the last time it left Base go to Base, for scoring or continued use.

objects that were not with the robot the last time it left Base are taken out of play (may not be used again).

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## Missions and Rules for 2009 Smart Move FLL Competition

### ■ 22 - Active Robot Touched In Base

If the robot *or any objects* in its strategic control are *at least partially in* Base...

there is no “touch penalty.”  
those objects are placed in Base for scoring or continued use.

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### ■ 23 - Tethers/Leashes

If the only part of your robot in Base at the time of an active robot touch is a cord, hose, wire, tube, chain or string, the robot is treated as if it were completely out of Base.

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### ■ 24 - Loss Of Contact

If an untouched robot loses contact with an object, that object stays where it is unless/until the robot regains contact with it. Such objects may not be recovered by hand.

For exceptions, see the STRAY OBJECTS and ROBOT DAMAGE rules.

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### ■ 25 - Stray Objects

Objects *caused by any robot* to be in a non-scoring position may be taken out of play by the ref upon request, or by you if the ref is too far away to act in time. Objects “taken out of play” may not be used again.

Objects in their original “setup” positions are never considered stray.

Objects in scoring position are never considered stray.

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### ■ 26 - Robot Damage

At any time, you may recover robot parts that come off as a result of obviously unintentional damage.

You may do this by hand or request help from the ref.

Parts planned or designed to come off are strategic objects, and are covered under the LOSS OF CONTACT rule.

# Missions and Rules for 2009 Smart Move FLL Competition

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## 27 - Field Damage

Field damage is defined as:

- whenever a mission model is broken or malfunctioning.
- whenever a Dual Lock connection is separated.
- any change to your field that is not caused by your robot.
- any change to your field that is caused by an inactive robot.
- any change to your field that violates a rule or Game Q&A ruling.

When field damage occurs, the ref is placed in the difficult position of having to recall the field's condition right before the damage, and restore it to that condition.

Field damage too severe to reverse is left as is or swept away.

If scoring is in question after field damage that was mostly due to faulty model design, construction, or setup, you get the points.

If scoring is in question after field damage that was mostly due to your robot acting with too much force and/or not enough accuracy (messing up), you are more likely to get the a "benefit of the doubt" call, along with a warning, in Round 1 than in later rounds.

It is not field damage and the field does not get restored when your robot simply does things you don't like.

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## 28 - Interference

Your robot is not allowed to have any effect on the other team's robot, field, or strategy, except by directly meeting the scoring requirements of missions in areas that are shared between the two sides by design of the Robot Game.

There is always at least one mission where you and the opposing team are set up to interact in some way, either competitively or cooperatively.

As a matter of luck, that team may be able to out perform you on that mission or may fail to cooperate with you there. This is not considered interference.

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## 29 - Final Field Condition

To minimize controversy about what happened during a match, the score is determined at the end of the match, by the SNAPSHOT condition of the field at that EXACT time only.

This means that points are not given for results your robot gets but then trashes before the match ends.

This is also why actions that are not allowed (rule violations) are either stopped or reversed as they happen.

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# Missions and Rules for 2009 Smart Move FLL Competition

## 30 - IN

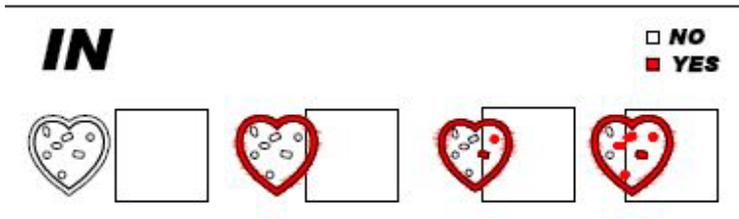
A is "in" area B if any bit of A is over area B.

Barely "in" is considered "in" unless the word "completely" is used.

Direct contact (touching) is not part of the definition of "in."

Objects in a container are ruled on individually, and independent of their container.

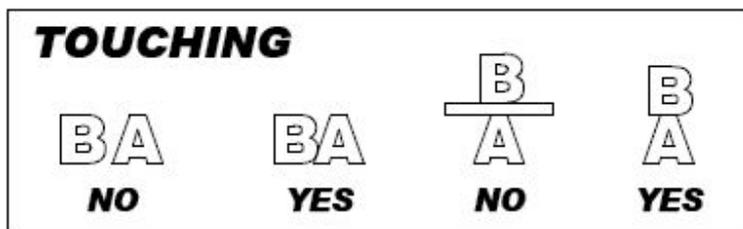
Exception: Objects returning to Base with your robot are considered IN as soon as the robot reaches Base.



## 31 - TOUCHING

A is "touching" B only if A is making direct contact with B.

Any amount of direct contact counts as touching.



## 32 - Benefit of the Doubt

You get the benefit of the doubt when:

- a split-second or the thickness of a (thin) line is a factor.

- a situation could "go either way" due to confusing, conflicting, or missing information.

- anyone other than the challenge designer claims to know the "intent" of a requirement or constraint.

If you (kids, not coach) disagree with the ref and can respectfully raise sufficient doubt in his/her mind, the ref meets with the head ref, and the resultant decision is final.

This rule is not an order for the refs to be lenient, but it is a license for them to make judgment calls in your favor when it's reasonable to do so.

## Missions and Rules for 2009 Smart Move FLL Competition

### 33 - Precedence

When there is conflict between pictures/videos and text, the text takes precedence. When there is conflict between a mission and a rule, the mission takes precedence, but the current Game Q&A page on the web takes overall precedence. **MAKE SURE TO CHECK BACK THERE OFTEN.**

The head ref is not obligated to consider calls made at previous tournaments unless those calls have been added to the latest Game Q&A.

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### 34 - After The Match

No one is allowed to touch anything on the field yet...

The ref first needs time to record the condition of the field, and come to agreement with you (kids) about what points were scored or missed and why (and to be sure you're not walking away with any of that field's mission models!). Data is marked on a sheet which you initial.

The scores are tallied by computer, with ties being broken using 2<sup>nd</sup> and then 3<sup>rd</sup> highest scores.

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### Challenge Support

Official Robot Game support is available through [filltech@usfirst.org](mailto:filltech@usfirst.org) (usual response in 1-2 business days).

Before you e-mail, be sure you've read the Field Setup, the Missions, these Rules, and the updated Game Q&A, since filltech refers to these and only these, exactly as you and the refs are supposed to.

E-mail replies you get are only to guide you. Refs are not obligated to read them. When e-mailing, please state your role on the team (member, coach, parent, mentor). filltech can help you construct rule-based paths of reason for assessing special strategies or situations.

filltech may share the answer to your question on the Game Q&A if the question is popular, reveals missing or confusing text, reveals a flaw in the game, reveals an unresolvable conflict, or is amazing or entertaining.

No new Game Q&A entries are to be posted after 3PM (eastern U.S.) on Fridays.

filltech does not answer questions about building or programming the robot (that's your challenge).

filltech can not support LEGO product (RIS, RoboLab, NXT). Instead call 1-866-349-5346.

filltech does not respond to questions posted in the discussion forum. The forum is great for sharing ideas and getting tips from other teams, but it is **NOT AN OFFICIAL SOURCE OF ANSWERS** about anything.

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## **Missions and Rules for 2009 Smart Move FLL Competition**

### **Coaches' Meeting**

If a question does come up right before the tournament, your last chance to ask it is at the "Coaches' Meeting" (if there is one) the morning of the tournament.

The head ref and coaches meet to identify and settle any differences **before** any matches start.

For the rest of the day, the ref's calls are final when you leave the table.

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### **Summary Of Significant Content Changes For 2009**

A - The restriction against attaching things to mission models has been removed.

B - The robot and everything it has, can now be pulled into Base as soon as any of it reaches Base.

C - Stray objects must now be taken off the table if they're going to be moved at all. Shifting is not allowed.

D - A tethering rule allows tethering while preventing teams from using it to avoid a touch penalty.

E - The definition of ON has been removed.