# FIRST LEGO LEAGUE 2009

## SMART MOVE

# Challenge Documentation

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## What is the Challenge?

**The Challenge is what the kids are tasked to do…**

Every year, FLL works with experts in the field to create a Challenge that relates to a significant real-world issue. The end result is a two-part Challenge that requires research to complete The Project, and science and engineering to master the complex missions of The Robot Game, which includes the Missions and the Rules. It's a fun way to get kids excited in science and technology.

The Kickoff date for the upcoming *FIRST* LEGO League season is in September 3, 2009. At Kickoff, teams can access all materials related to the new Challenge. They can download the Challenge project guidelines, access the rules and missions of the new robot game, and view a playing field. Many teams gather on Kickoff day for a team party to celebrate the new Challenge.

- The 2009-2010 Challenge Kickoff is September 3, 2009.

- The 2010-2011 Challenge topic will be BIOMEDICAL. Stay tuned in the coming months for more information.

**Want to know more about the basics of the Challenge? Read below for some general definitions.**

**What is the Robot Game?**

In the Robot Game, teams design, build, program, and test autonomous robots that must perform a series of tasks, or missions within a 2-1/2 minute time limit. The game and its missions often symbolize solutions to some of problems presented in the Challenge theme. The missions are performed on a standard FLL Field, under a set of rules (see also Field Setup).

**What is the Project?**

In the Project, teams research a real-world problem in the field of the Challenge theme, create an innovative solution, and share their findings in their community. FLL is not just about building and competing with robots. *FIRST* encourages well-rounded teams because any successful engineering project requires a wide variety of skills. Through the project research, teams learn more about the science behind the Challenge theme and better understand the work of professionals in that field.

Presenting this material allows the team members to showcase what they have achieved through their project, and is an opportunity to share the excitement of science and technology with others. It also offers an opportunity for team members to motivate others to act. Sharing the solution could involve presenting at a town meeting; talking with a government official; speaking in a school assembly or in front of a class; or creating a brochure or video to send to the library or public access channel. The Project is a part of the judging process for qualifying and Championship tournaments. Each team has five minutes, including setup, to present its project to a panel of judges.

**What's involved with Field Setup?**

The Standard FLL "Field" is the obstacle course where the robot performs missions. The "Field Setup" instructions page is a detailed guide for making a correct field; a field identical to the one used at a tournament.

**Standard FLL Table** (supplies for this are purchased at a hardware store):
Follow simple instructions to attach a sheet of smooth white board to a sheet of plywood (both 4 foot by 8 foot), then cut and attach a perimeter of two-by-four borders. You build the table in your first year with FLL, and never need to build it again.

**Building Instructions**

**Field Setup Kit** (purchased along with the team registration fee) includes a Field Mat, and a box containing LEGO bricks and a CD:

- Place your Field Mat on the table between the two-by-four borders. The mat is a thin plastic covering featuring designs and location marks related to each year's robot game.
- Build the Mission Models. These are LEGO structures related to each year's robot game, which the robot interacts with. Instructions for this step are on the CD that came in the box.
- Place the Mission Models on the Field Mat just right, and you're done!

# Smart Move

## Robot Game Field Setup

**Contents**

### OVERVIEW

- 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, in the same box as the LEGO pieces.
- The instructions for how to build the table and how to arrange everything on it are here…

### TABLE CONSTRUCTION

The Robot Game takes place on a specially designed table, so you'll need to build one to practice on if you don't already have access to one.  With safety, weight, height, and cost in mind, a simple design is offered here, but as long as your surface is smooth, and your border walls are located properly, how you build the understructure is up to you.  The construction is simple, but does require some wood-working skills.

At a tournament, two tables are placed back to back, but you only operate on one table, so you only need to build one table to practice on.  Since a tournament setup has a double wall at the interactive area where the two tables meet, practice tables need an extra wall of type **B** on the corresponding side.  So here are the instructions for building one "half-table" including a double north wall:

**Materials**

| Material | Quantity |
|---|---|
| Field Setup Kit (mission model LEGO elements, mat, CD, Dual Lock) | 1 |
| sanded plywood (or other very smooth board) 96" X 48" X 3/8" or thicker | 1 |
| two-by-four, 8' (actual cross-section = 1-1/2" by 3-1/2") | 4 |
| two-by-three, 8' (actual cross-section = 1-1/2" by 2-1/2") | 2 |
| flat black paint | 1 pt. or spray can |
| coarse drywall screws, 6 X 2-1/2" | 1/2 lb. |
| saw horses, about 24" high and 36" wide | 2 |

## Parts

| Part | Make From | Dimensions | Paint | Quantity |
|---|---|---|---|---|
| table surface (**A**) | plywood | 96" X 48" | no | 1 |
| long border wall (**B**) | two-by-four | 96" | yes | 3 |
| short border wall (**C**) | two-by-four | 45" | yes | 2 |
| stiffener (**D**) | two-by-three | 48" | no | 4 |
| saw horse | purchase | H ≈ 24"  W ≈ 36" | no | 2 |

## Assembly

**Step 1** - Determine which face of the plywood (**A**) is least smooth, and consider that the bottom face.  On the bottom face, locate, clamp, and screw on the stiffeners (**D**) (about every 18 inches).  Be sure screw head tops are flush.  Sand any splinters.
**Step 2** - On the top face of the plywood, locate, clamp, and screw on the border walls (**B**,**C**) around the top perimeter.  The wall-to-wall dimensions must measure 93±1/8" by 45±1/8" (2362±3mm by 1143±3mm).
**Step 3** - With the help of another person, place this table top on short saw horses (or milk crates, or anything else short and solid).
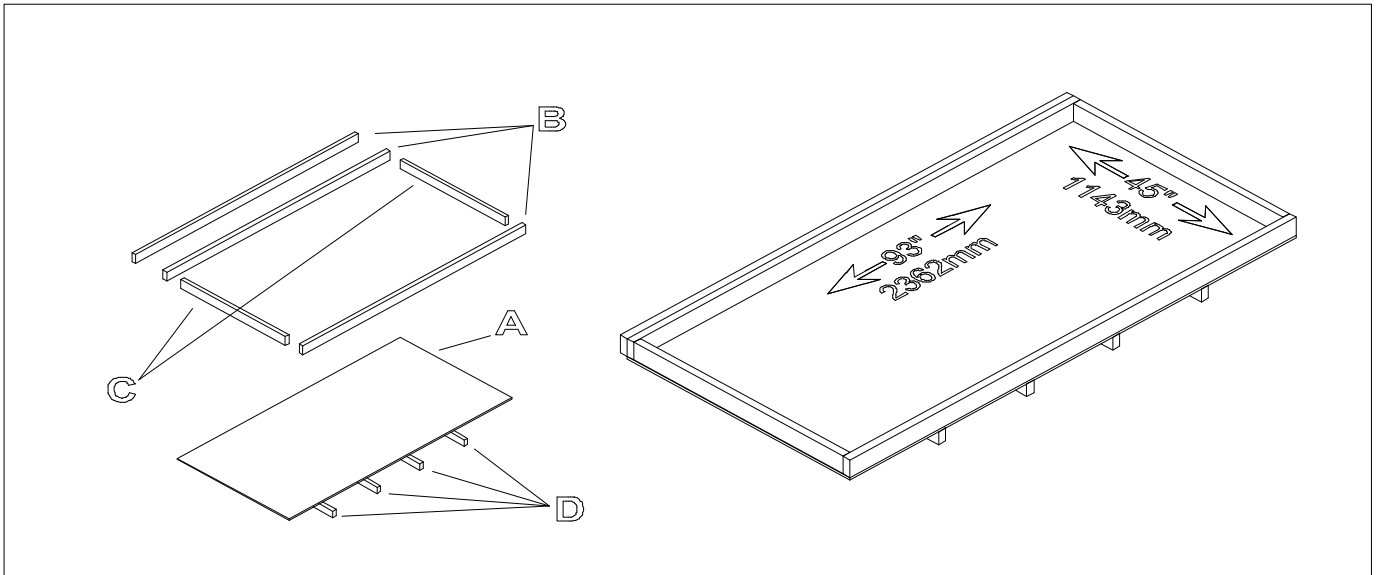


## FIELD MAT PLACEMENT

**Step 1** - Vacuum the table top.  Even the tiniest particle under the mat can give the robot trouble.  After vacuuming, run your hand over the surface and sand or file down any protruding imperfections you find.  Then vacuum again.
**Step 2** - On the vacuumed surface (never unroll the mat in an area where it could pick up particles), unroll the mat so the image is up and its north edge is near the north/double border wall (note the location of the double wall in each table sketch below).
**Step 3** - The mat is smaller than the playing surface by design.  Slide and align it so that there is no gap between the south edge of the mat and the south border wall. Center the mat in the east-west direction (look for equal gaps at left and right).
**Step 4** - With help from others, pull the mat at opposite ends and massage out any waviness away from the center and re-check the requirement of Step 3. It is expected that some waviness will persist, but that should relax over time.  Some teams use a hair dryer to speed the relaxation of the waviness.
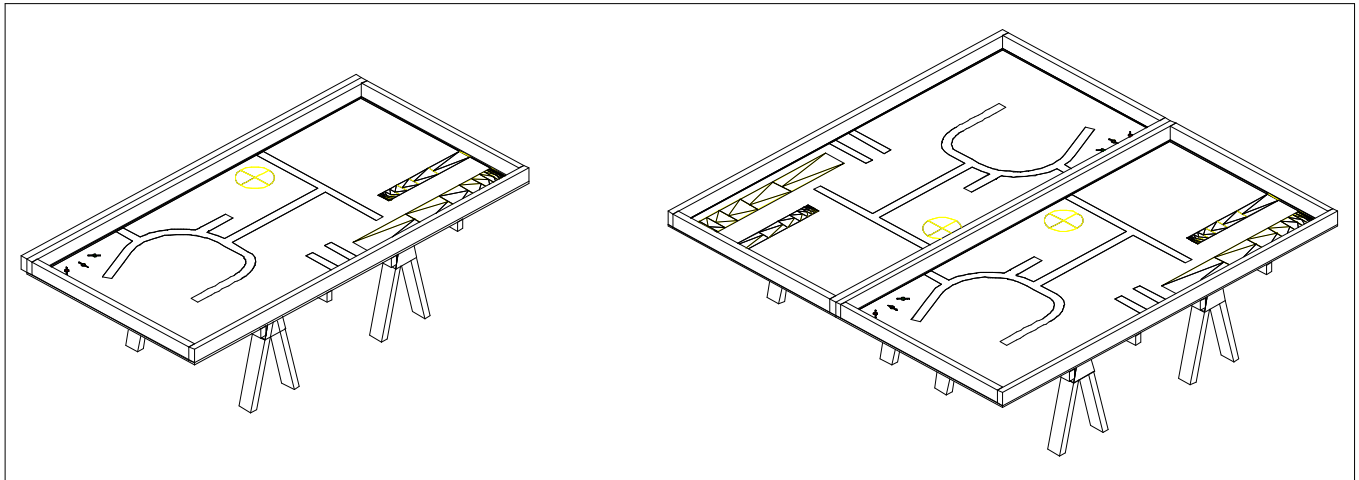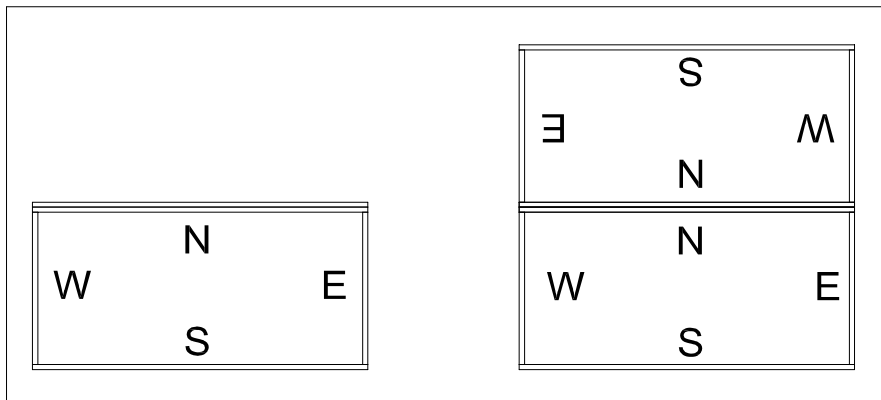
## MISSION MODEL CONSTRUCTION

Build the mission models - Use the LEGO elements and instruction CD from your Field Setup Kit.  It should take a single person between two and three hours to do this, so it's best done in a work party.  If there are any team members with little or no experience building with LEGO elements, mission model construction is a great way to learn.  This step is also a nice time for new team members to get acquainted with each other.

## MISSION MODEL ARRANGEMENT

### Dual Lock

For models where "Dual Lock Needed" appears in the mission model details below, that means the model needs to be secured to the mat during use.  The connection is made using the re-usable fastening material from 3M called Dual Lock, which comes in the flat clear bag with the LEGO elements in your Field Setup Kit.  Dual Lock is designed to stick or "lock" to itself when two faces of it are pressed together, but you can unlock it too, for ease of transport and storage.  The application process for the Dual Lock is only needed once.  Later, the models can simply be locked onto the mat or unlocked.  To apply Dual Lock:

**Step 1** - Stick one square, adhesive side down, on each box you see on the mat with an "X" in it.
**Step 2** - Press a second square on top of each of those, "Locking" them on, adhesive side up. TIP: Instead of using your finger, use a bit of the wax paper the squares came on.
**Step 3** - Lower the model onto the squares.
**CAUTION** - Be sure to place each square precisely on its box, and each model precisely over its marks.
**CAUTION** - When pressing a model down, press down on its lowest solid structure instead of crushing the whole model.  Pull on that same structure if you later need to separate the model from the mat.
**TIP**:  For large/flexible models, apply only one or two sets at a time.

## Model Details

**Bridge** - Dual Lock Needed - Get familiar with the bridge's exact placement before applying Dual Lock, then apply Dual Lock at one or two locations at a time, from south to north.  After the six mat contacts are done, use three Dual Lock pairs to secure the red deck to the border wall (one pair at each end, and one pair at center).  Prop up the hinged black deck by standing its swivel beam's end on the tiny black mark.



**Crash-Test Ramp** - Dual Lock Needed - CAUTION:  Be sure to not distort this model as you secure it.  Set the hinged fence-like structure vertical (with the red beam being at its highest point as can be determined by eye).

**Truck** - (NO Dual Lock) - The truck is pointed down the ramp with its rear axle being held by the ramp's red beam.  The truck should be centered side-to-side on the ramp, and parallel to it.  The truck's centering and parallelism should be as perfect as can be determined by eye, with the understanding that imperfection here adds expected/acceptable variability to the game.
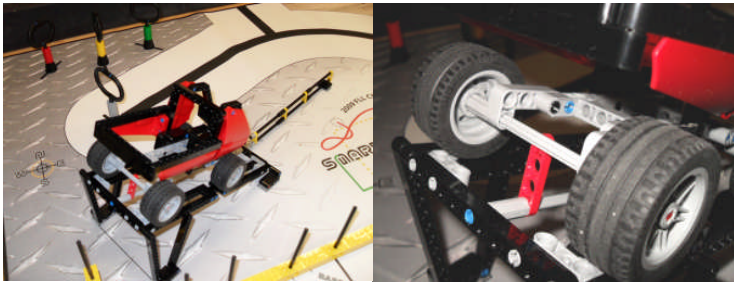


**Access Markers** - Dual Lock Needed – The access markers are directional.  Be sure to place their oval feature over their mark on the mat.  Once each model is secured, it needs to be "set."  Pull up on the green wheel, wait a few seconds until the black bumper stops swinging, then lower the wheel.  A ball under the center of the bumper will settle into a cup.  The exact rotation of the bumper is variable, but be sure there is some free space around the solid post/axle.



**Guide Walls** - Dual Lock Needed - Two guide walls are placed in the southeast, and one is just north of Base.  Quite simple!

**Dynamometer** - Dual Lock Needed - This model is in the middle of the east half of the field, and both ends are identical. After pressing it down, test to be sure its rollers spin freely.  If they don't, be sure the model is pressed all the way down evenly, be sure there is north-south free-play for the axles, and be sure they're not bent.

**Sensor Walls** - (NO Dual Lock) - Stand four sensor walls on their marks in the northeast, studs up.  The last one lies flat across the tops of the three tall black cylindrical columns.  Place the square bases of those columns on their marks west of the bridge, toward the north, then carefully balance the sensor wall on top, with its studs facing south.
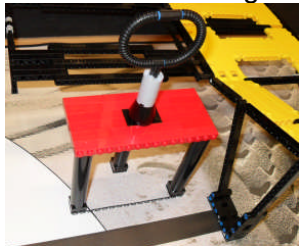


**Warning Beacons** - (NO Dual Lock) - Stand each of the eight warning beacons on its small black circle, studs up.  Five go between Base and the bridge, and three are just north of the east guide wall.

**Loops** - (NO Dual Lock) - There are eleven loops.  Eight of them stand on the mat on their corresponding colored marks with their loops aligned as each mark shows.  The remaining two gray and one red are placed on other models, with their loops aligned parallel to the long border walls as follows:  Stand one gray loop centered on the sensor wall which is on columns.  Stand the other gray loop centered on the southwest axle of the south guide wall.  Stand the red loop centered on the east-most axle of the south guide wall.  Be sure all loops are vertical.
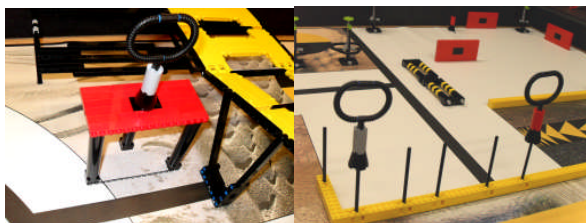


**People and Crash-Test Figure** - (NO Dual Lock) - Place these five models in Base.  Their exact position is unimportant.

## FIELD MAINTENANCE

- **Border Walls** - Remove any obvious splinters, and cover any obvious holes.
- **Field Mat** - Make sure the mat touches the south border wall, and is centered east to west.  Avoid cleaning the mat with anything that will leave a residue.  Any residue, sticky or slippery, will affect the robot's performance compared to a new mat (many tournaments use new mats).  Use a vacuum and/or damp cloth for dust and debris (above and below the mat).  When moving the mat for transport and storage, be sure not to let it bend into a sharp kink point, which could affect the robot's movement.  Tournaments using new mats should unroll the mats as far in advance of the tournament day as possible.  For control of extreme curl at the east or west edges of the mat, tape is allowed, with a maximum of ¼" (6 mm) overlap.  Foam tape is not allowed.
- **Mission Models** - Keep the models in original condition by straightening and tightening solid connections often.  Ensure that spinning axles spin freely by checking for end-to-end play and replacing any that are bent.

# SMART MOVE

## Robot Game Missions

**WARNING:** **Like chess and soccer, this game has rules too!**
**You absolutely must know them.**

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!

**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.

**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.

**VEHICLE SHARING -** Required Condition:  Parked with its drive wheels or treads touching your red bridge decking, but not touching the mat.
Value:  25 points.

**GAIN ACCESS TO THINGS…**

**ACCESS MARKERS -** Required Condition:  Access markers need to be in their "down" position.
Value:  25 points each.

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

Value:  10 points each.

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.

## 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.

**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.

## SURVIVE IMPACTS…

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

Value:  40 points.

**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.

**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.

**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.

# SMART MOVE

## Robot Game Policies, Procedures, Definitions and Rules

### 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.

### 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.

### 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.

### 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.

_____

### 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.

### 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: | For NXT users: |
|---|---|
| RCX controller (1) | NXT controller (1) |
| motors (3) | motors (3) |
| touch sensors (2) | touch sensors (2) |
| light sensors (2) | light sensors (2) |
| lamp (1) | lamp (1) |
| rotation sensors (3) | rotation sensors (3 minus the number of NXT motors present) |
| 3$^{rd}$ touch OR light sensor (1) | 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$^{rd}$ motor from one attachment to the next.
- 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.

## 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.

## 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.

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

## 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.
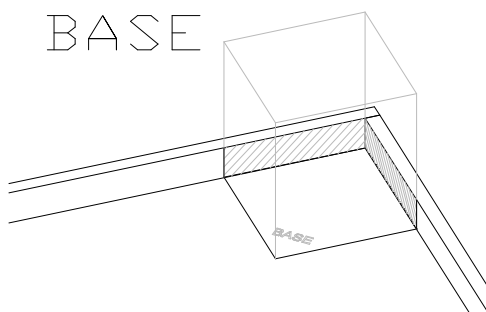


## 7 - VARIABILITY

- 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.

## 8 - MISSION

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

## 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.

### 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.

### 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.

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

### 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.

### 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.

### 15 - HOUSEKEEPING
- After the referee (the "ref") inspects everything you've brought to the competition area, you may store it all 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.

### 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.



START POSITION

NO   NO   YES   NO   YES   NO   YES
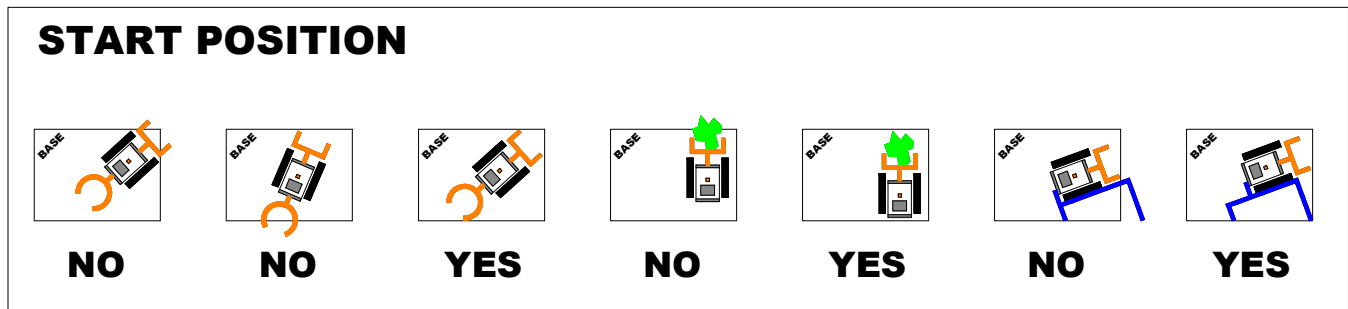
## 19 - START PROCEDURE
- When it's obvious to the ref that starting position is correct…
  - o   For the start of the match…
- The ref asks you if you're ready, then signal your readiness to the announcer.
- As the countdown starts, you reach in with one hand, ready to either touch a button, or signal a sensor, to start or resume your robot's program.
- When you hear the sound, you start your robot.
  - o   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.

## 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.

## 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).

## 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.

## 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.

## 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.

## 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.

## 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.

## 27 - FIELD DAMAGE

- Field damage is defined as:
  - o   whenever a mission model is broken or malfunctioning.
  - o   whenever a Dual Lock connection is separated.
  - o   any change to your field that is not caused by your robot.
  - o   any change to your field that is caused by an inactive robot.
  - o   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.

## 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.

## 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.

**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.
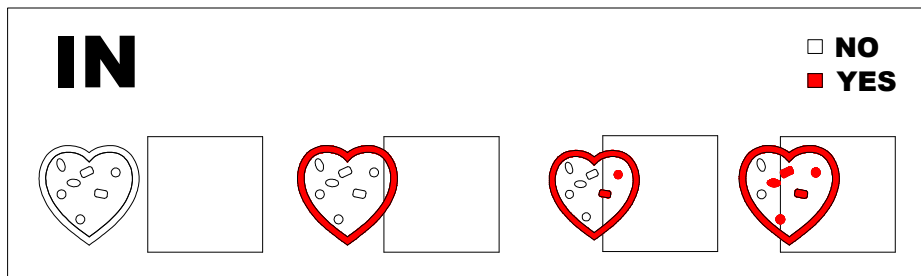


**31 - TOUCHING**
- A is "touching" B only if A is making direct contact with B.
- Any amount of direct contact counts as touching.
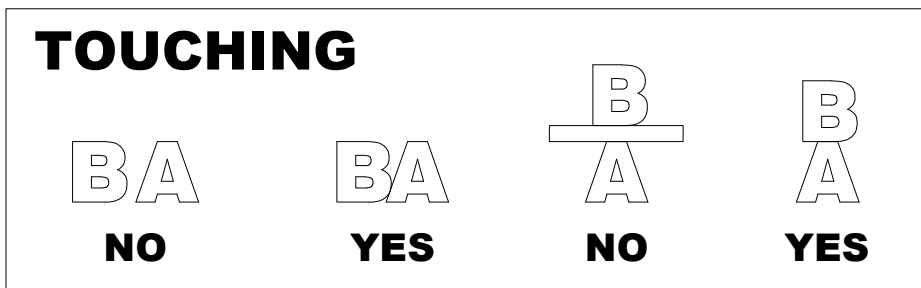


**32 - BENEFIT OF THE DOUBT**
- You get the benefit of the doubt when:
  - a split-second or the thickness of a (thin) line is a factor.
  - a situation could "go either way" due to confusing, conflicting, or missing information.
  - anyone other than the challenge designer claims to know the "intent" 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.

**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.

**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.

_____

## CHALLENGE SUPPORT

- Official Robot Game support is available through flltech@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 flltech 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).
- flltech can help you construct rule-based paths of reason for assessing special strategies or situations.
- flltech 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 be posted after 3PM (eastern U.S.) on Fridays.
- flltech does not answer questions about building or programming the robot (that's your challenge).
- flltech can not support LEGO product (RIS, RoboLab, NXT). Instead call 1-866-349-5346.
- flltech 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.

## 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.

## 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.

# SMART MOVE
## The Project

## THINK ABOUT IT

Each and every day, transportation touches your lives. Your team travels to the places where they learn, to the places where they play, to visit friends and family. Things we want, clothes we wear, the food we eat, the water we drink, medicines we need—all these travel over highways, on paths and trails, along railroad tracks, up and down rivers, across oceans, over mountains and deserts, along the streets we live on. Information travels to us from experts, teachers, friends, and family. It comes to us by word-of-mouth, over the phone, in books, from websites, in text messages.

Now, consider. A potato chip can travel through a factory—flying from machine-to-machine without being broken—but more than 50,000 kids who traveled on skateboards had to be taken to the hospital. Is all this travel as safe as it could be? Millions of people (and the things they need) get stuck in transit every day. Is all this travel as efficient as it could be?

Your challenge this season is to look at your community and discover how people, animals, information, and things travel. Once you know how people and things move in your community, pick one main mode of transportation and do some research. What kinds of problems keep people and things from getting where they are going safely? What kind of problems keep people and things from moving efficiently, getting where they are going quickly and using the least amount of energy? How could your team help solve one of those problems?

## IDENTIFY A PROBLEM

Begin your project by describing your community. This season, it is up to your team to define your community. Is it your school? your neighborhood? your city, village, or town? your country? the world? Be prepared to share how you defined your community.

Next, create a list of the ways that people, animals, information, and things

move in, around, to, and through your community. Be creative. Be silly. Be serious. Think about everything that gets moved, including yourselves!

Once your list is complete, pick one way that people and things move in your community and learn more about it!

Whether your team chooses planes, boats, trains, cars, trucks, skateboards, roller blades, bicycles, donkeys, llamas, camels, your feet...it's time to research. What makes your mode of transportation dangerous? What prevents people, information, animals, and things from getting where they need to go? What makes them take longer? What makes them burn more fuel? Search out the problems. Look at reports. Read books. Browse websites. Conduct a survey. Check with experts who work in and around your community. Use any research tools you have available. Be prepared to share your information sources.

## CREATE AN INNOVATIVE SOLUTION

Choose one of the problems and suggest a solution. What can be done to fix the problem? What will it take to make your team's solution happen? How will your solution help your community? How can your team make moving from one place to another safer and easier? A great solution might take all the imagination and ingenuity your team can muster. It might seem so obvious that you wonder why the problem even exists. And remember, the most important thing is to have fun while you make a Smart Move.

## SHARE WITH YOUR COMMUNITY

Now, tell your community about the problem you researched, and how your solution can help. You choose how to share what you've learned. Give a talk for parents. Create a website. Perform a skit. Make a comic book. Rap. Create a poster. Pass out flyers. Write a poem, song, or story. Present your research and solution to lawmakers.

Your presentation to the judges can be simple or elaborate, serious or designed to make people laugh while they learn—but to be eligible for project awards at tournaments, it must:
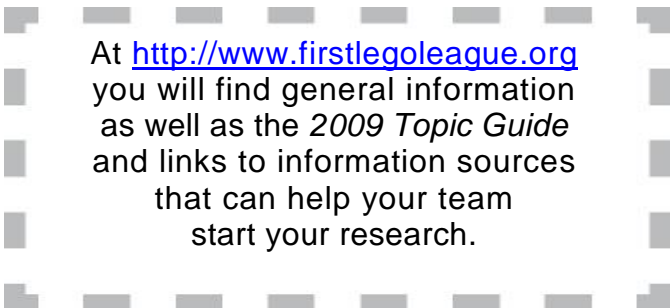
- Describe your community, the problem, and your team's solution

- Show that your team did the research and tell about your information sources

- Be shared with someone outside of your team

Note: The total length of your project presentation at a tournament or qualifier should be no more than five minutes, including any setup time.

## NEED HELP GETTING STARTED?

The *2009 Smart Move FLL Coaches' Handbook* contains more information about *FIRST* LEGO® League, the Smart Move Challenge, tournaments, awards, and scoring. Be sure to look at the project rubric.

Information and resources are also available online.

At http://www.firstlegoleague.org you will find general information as well as the *2009 Topic Guide* and links to information sources that can help your team start your research.

If you have more questions, email fllprojects@usfirst.org for project support or flltech@usfirst.org for game support.

# SMART MOVE

## Project How-To Guide

**NOTE:** Chapter 5 of the FLL Coaches' Handbook (4th Edition) has additional resources about completing the project.

**Why a Project?**

The exploration of the FLL project is critical to the overall Challenge experience. FLL is not just about building and competing with robots. It is about making connections between the robot missions, our scientific understanding of the Challenge theme, related problems and innovative solutions.

*FIRST* encourages its teams to be well-rounded. Any successful engineering or technology project requires a wide variety of skills and abilities. For example, the Mars Rovers would not have been as successful if the NASA team working on them did not have people who know about the climate and terrain the robots would face on Mars working with the designers and engineers.

Before getting started on this year's project, we highly recommend that your whole team watch the Challenge Project Training DVD. Keep in mind, however, that the steps of the project have shifted since the DVD was developed. Therefore it is essential to refer to the project assignment and kickoff material posted on the FLL website for the most up-to-date information about the project.

**Getting Started**

Specific instructions for this year's project will be posted on the FLL website at kickoff. Generally the project has three steps:
- through research, identify a real world problem related to the Challenge theme,
- create an innovative solution,
- and share your research and solution with your community.

Read this year's project very carefully before getting started.

To qualify for awards your team needs to share all three steps of the project through a creative and informative presentation with judges at an FLL event.

Although the project may seem daunting at first, if you break it down into smaller parts it becomes more manageable. There is a sample schedule in Chapter 9 of the FLL Coaches' Handbook outlining how your team can complete the project over eight weeks.

**The Specifics**

**Identify a real world problem**

You can start to identify your team's focus for the project by:
1. Reading the assignment very carefully with your team. Allow team members to ask questions to clarify any parts that they do not understand.
2. Discussing the theme as a group and brainstorm some general ideas about the topic.
3. Choosing three or four main ideas and then break the team into small groups to research these ideas. A list of good sources of information is available at the end of this guide.
4. Coming back together as a team and sharing the results of the research.
5. Deciding which aspects of the research are the most important and/or relevant to the project. Rank the ideas by importance.

### Create an innovative solution

Your team needs to agree on one unique solution to your problem. Innovative means the solution is not already in use by someone else. It can be a new idea or an improvement on an existing idea. To do this, you may want to develop ideas individually or in small groups and then present them to the team, or you may want to collaborate on an idea together. If starting separately, consider combining the strengths of several solutions to create a final solution.

6. Brainstorm ideas with your team
7. Begin to develop a variety of designs
8. Draw pictures of your proposed solutions and/or innovations to current solutions
9. Present each possible solution to the team
10. As a team, select one solution to focus on (this design may combine the strengths of several designs)
11. Come together as a team to improve upon your chosen solution
12. If it makes sense, build a prototype of your solution

### Share your research and solution

This step is critical to completing the project and is not just about practicing your presentation. It is a chance for your project to make a difference. It is an opportunity to share the excitement of science and technology with others. This may even be an opportunity to motivate others to act.

13. Brainstorm who you can share your findings with such as your school, a governing group, a local company, a community organization, or other FLL teams. Think about who would be most interested in what you have learned and/or who might be able to use the information positively.
14. Select who you want to share your findings with and make arrangements for the presentation to be completed prior to developing your project presentation for your FLL event.
15. Organize and prioritize the information you want to share.

### Deciding *what* to share with the judges

Since you have only five minutes for your project presentation at FLL events, you must carefully select the information you will include on the basis of:

- Importance to the project theme
- Aspects on which you have solid information and data.
- Information and data that relates closely to the problem you have focused on and innovative solution you have created.
- Material that fits your team's presentation style or format.
- Relevance to the three steps of this year's project.

### Deciding *how* to share with the judges

In the final process of developing the presentation there are four major considerations:

- Showing how you achieved all project objectives and all three steps of the project.
- Selecting a creative format or style of presentation that complements your information and team member skills. (The options are broad, including but not limited to a discussion, formal presentation with props, skits, songs, music and/or video.)
- Using the project rubric found in the back of the current FLL Coaches' Handbook, as a guideline for what judges will look for and paying close attention to qualities listed in the excellent column.
- Setting a standard of quality. (See below how you can understand the FLL standard of quality for project presentations.)

## Polish and *perfect*

Take some time to discuss the following suggestions as a team. This way, everyone understands what will help make the work easier and the end result more successful and fun.

1. Standard of Quality
   The best way for your team to understand the standard of quality for project presentations is to see some presentations. Some FLL tournaments allow team members and the public to view all project presentations. If this is true at your event, take advantage of it! At other FLL tournaments the best presentations are part of the closing ceremony. If so, pay attention!

   You can also ask another team to rehearse their presentation for you or watch the presentations available on the Challenge Project Training DVD. The Minnesota-based FLL organization called "High Tech Kids" provides examples of winning presentations from previous years at www.hightechkids.org

2. Understand and achieve the objectives.
   Past experience shows that the most successful projects and their presentations are guided by the FLL theme and project guidelines. The first step in developing your project, therefore, is a complete understanding of the theme and the guidelines for this year.

3. Involve the Community
   Your community is a very important source of support and help. Draw on members of your community for advice, resources, information and guidance. Community organizations will promote your team's involvement in the FLL project when you demonstrate mutual interests.

4. Survey team's talents
   This is your team's chance to shine! What can team members contribute to make the presentation special? Are any students interested in the arts ... playing instruments, acting, singing or poetry? Do any have special technology talents regarding websites, video animation, etc? Start from these strengths and design your presentation around them.

5. Practice, Practice, Practice
   Finally, your practice sessions should also include questions and answers. You may want to consider inviting parents, teachers, or other students to view a dress rehearsal of your presentation. This critical audience can ask questions of the team, give feedback, and support the team by offering positive encouragement.

## Sources of information

- Published sources, such as:
  o The FLL website includes a project guide each season with links to useful information and activities.
  o Libraries
  o Government agencies
- Knowledgeable people and organizations:
  o Scientists or professionals whose work relates to the theme. They may be local or contacted by phone, mail or email. Don't forget to check with team parents!
  o Community organizations with interest in the Challenge topic.
  o Universities and colleges that have experts in the field.
  o Corporations whose businesses relate to the theme.
  o High schools or other schools that teach these topics.
  o Tour a business related to the theme.

Keep in mind that knowledgeable people may come from all walks of life!

# Talking with Experts –
# Preparation Ideas and Sample Interview Questions

Talking with experts who work in the field of the Challenge theme is a great way for your FLL team to learn more about the topic, find out current data, discover potential problems, and learn what is being done about those problems. Experts can include a variety of people like scientists, engineers, community leaders, university professors and students, and anyone whose life or work is affected by the Challenge theme.

**Preparing for Your Interview**

You should contact your expert well in advance to see if they are able and willing to help on your project. Find out their preferred way to conduct the interview (in person, over the phone, electronically). Set up a time and start getting ready for the interview.

Before the day of the interview, your team should prepare a list of questions. Plan for concise, to-the-point questions that will help you achieve your project goals and make the best use of your time with the expert. Try to anticipate how long it will take for all the questions and answers so you can keep the interview in the scheduled time length. Keep your questions to the topic of your specific presentation.

It is helpful to write down your questions and have them in front of you when you are interviewing. You may even consider sending a list of questions to your expert in advance so they can properly prepare. Decide ahead of time which team member(s) will ask each of the questions. Always remember to exhibit Gracious Professionalism during your interview and be respectful of the time given to you by the expert. Treat the expert like a member of your team and remember to thank them for their contribution!

**Smart Move Experts and Sample Questions**

Transportation Experts

Certain types of experts who work with transportation issues everyday may be particularly helpful to talk with for your project. These may include:

- Information Technology (IT) specialists
- Mayors
- Regional or urban planners
- City or town council members
- Air traffic controllers
- Community leaders
- Lawmakers
- Auto engineers
- Internet service providers
- Import/export business owners
- School bus company employees
- School principals and superintendents
- And many, many more!

## Research Questions

There are certain questions you should answer through research prior to interviewing any experts. These will help everyone on your team have an understanding of the basic project and Challenge elements.

Some of these questions may include:

- How does our team define our community?
- How do transportation problems affect our lives?
- What forms of transportation are available in our community?
- Which forms of transportation does our team use? Which ones do we wish we could use?
- Who is affected by problems with transportation? How are they affected?

## Interview Questions

As you prepare for your interview, you will need to think of questions that specifically address the project topic your team has selected. However, some teams may talk to experts before selecting a specific problem and the questions below are a helpful guide to get you started.

Some *sample* interview questions include:

- How did you get into your career?
- What is the most important transportation question facing our area?
- Do you know of any other areas in the world facing similar transportation challenges?
- How do you improve transportation in your job?
- How could our transportation network be made safer? Or, how could our vehicles be made safer?
- How do you think transportation could be improved in our area?
- Do you think our community's transportation system works well for children? The elderly? Adults?
- What can be done to make our community's transportation network more efficient?
- What advice can you give the next generation about fixing transportation problems?
- What do you think transportation will be like in the future?
- How do you think we will get the things we want and need in the future? How might we get to school? Work? Our groceries? Information?

# Smart Move Activities

## Transportation Inventory

### Introduction

Create a map showing the types (modes) of transportation used and the amount of time required for each student to go from home to school in the morning. You may choose to survey just your class, a few classes, or the entire school.

### Procedure

Create a questionnaire.
Hand out the questionnaire to each person in your study.
Collect the responses and tally them in a spreadsheet.
 Set up a spreadsheet with columns listing the modes of transportation, leave home time, and arrival at school time. Create rows for each participant in the survey. Here's a sample:

| Participant | Modes of Transportation for Most Weather Conditions | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Walk | Bike | Car | Bus | Other | # of Modes | Leave Time | Arrive Time | Travel Time |
| Sally | 1 | | | 1 | | 2 | 8:30 | 8:50 | |
| Joe | | | 1 | | | 1 | 8:45 | 8:55 | |
| Samara | | 1 | | | | 1 | 8:40 | 8:55 | |
| Kim | | | | | | | | | |
| Janice | | | | | | | | | |
| Laurie | | | | | | | | | |
| Brandon | | | | | | | | | |
| David | | | | | | | | | |
| | | | | | | | | | |
| Participant | Modes of Transportation for Adverse Weather | | | | | | | | |
| | Walk | Bike | Car | Bus | Other | # of Modes | Leave Time | Arrive Time | Travel Time |
| Sally | | | 1 | | | 1 | 8:30 | 8:50 | |
| Joe | | | 1 | | | 1 | 8:45 | 8:55 | |
| Samara | | | 1 | | | 1 | | | |
| Kim | | | | | | | | | |
| Janice | | | | | | | | | |
| Laurie | | | | | | | | | |
| Brandon | | | | | | | | | |
| David | | | | | | | | | |

Create a poster, slide show or other visual presentation illustrating how your schoolmates are getting to school. Use the presentation to show the number of students using each mode of transportation. Find a way to show how students who use multiple modes of transportation, or who carpool, travel to school.

**Sample Questions**

6. At what time do you leave your home to go to school?
1. At what time do you usually arrive at school?
16. How do you get to school --- what mode(s) of transportation are used? Mark all that apply:
    a. Walk
    b. Bus
    c. Car
    d. Bicycle
    e. Train
    f. Other
2. How do you get to school --- what mode(s) of transportation are used when heavy rain, snow or other bad weather occurs? Mark all that apply:
    a. Walk
    b. Bus
    c. Car
    d. Bicycle
    e. Train
    f. Other

**Extension**
Brainstorm ways to improve the safety and efficiency of how students and teachers get to school.

Regional planning guides that might help include:

Smart Growth
http://www.smartgrowthamerica.org/transportation.html
Transportation is the backbone of smart growth. The structure of the transportation network is the skeleton that supports smart growth or sprawling development.

New Urbanism
http://www.newurbanism.org/transport.html

Smart Growth Transportation Websites
http://www.smartgrowth.org/about/issues/resources.asp?resource=12&type=8&res=1280 Links to a number of sites focusing on smart, sustainable growth

http://Streetfilms.org
http://livablestreets.com
Videos about getting around in urban areas

Also, be sure to check the complete list of Smart Move resources on the Project Resource page.

## Smart Move: Hubs and Modes Communication Game

In this game, students create a simple town by identifying places in the classroom as Hubs and Locations. Students move from one Location to another based on random selection of Action Cards. Hubs are places in which modes of transportation can be organized or people can switch modes, from a bus to a shared bike, for example.

*The goal is to visit as many locations as possible in 2 minutes of play while spending as few transportation tickets as possible.*

If 2 minutes proves to be too short for your group, try extending the time.

### Getting Started
- Identify the Hubs and Locations in your classroom or wherever your team meets.
- Make Action cards recommended below. The numbers of cards suggested are for a class of 15 students. You may find that you need to adjust the number based on the size of the group participating.
- Make 8 Transportation Tickets per player.

### Hubs

- Bus terminal
- Train station
- Airport
- Community Bicycle Rack
- Parking Garage

### Locations

- School
- Park
- Hospital
- Shopping Area
- Home
- Best Friend's House
- Friend's Home

### Actions
There are multiple copies of the action cards. See the suggested number to make in parentheses.

- Go to School (40)
- Go to Home 1 (20)
- Go to Best Friend's House (20)
- Telecommute to school (10)
- Shop online (10)
- Visit a friend (20)
- Surprise free vacation: Drop everything and go to the Airport! (2)
- Emergency! Drop everything and get to the Hospital! (2)
- Go to practice at the Park (20)
- Go see a movie at the Theater (20)
- Traffic jam! (4)

**How to Play the Game**

- Identify the **Hubs** and **Locations** in the classroom.
- Turn the **Action** cards face down and have each player draw 5 **Action** cards. o Each player receives 8 **Transportation Tickets**.
- Each player chooses to start at **Home 1** or **Best Friend's House** or at **School**.
- Players move from one **Location** to another as indicated by each **Action** card. Each move requires the Players pay one **Transportation Ticket** to a pile at the destination **Location** except where noted below. Players pickup a **Location** card at each stop.
- With the exception of the **bike rack**, getting to a **Hub** requires one transportation ticket, but it may save tickets in the long-term.
- Players win by collecting **Location** cards.
- All five Actions must be completed within the game play time. We recommend 2 minutes recommended to start, but you can adjust, as needed. Anyone not completing his or her **Actions** is out of the game. Rounds are played until there is a winner.
- The player with the most **Location** cards at the end is the winner.

Each Action requires one Transportation Ticket except:
1. Using Online Action card (such as Shopping Online or Telecommuting) – no cost
2. Going to and from the Bicycle Rack in between a Location – no cost
3. If Car Pool or Bus Routes are formed – no cost
4. Traffic jam – two Transportation Tickets required to get to your next destination

Individuals can group together to form a car or bus pool. To form a car pool, four players meet at the Parking Garage. Each must give up one transportation ticket and must then move together for one or more Actions. When moving as a car pool, only one person must give up a ticket for each move to a location so the more Actions that can be combined, the better.

To form a bus route, players meet at the Bus Terminal and go to a location together. When moving as a bus route, each players uses only one ticket for the entire ride.

In car pools or bus routes, hospital cards must be first stop, then vacation cards, then the rest in any order negotiated by the car or bus group.

If a student draws a **Hospital** card or an **Airport** card, that **Action** must be completed before any others.

Suggested random event to add when the play is understood:
Create a bad weather event, e.g., the teacher calls a snow day. A snow day breaks up all car pools and bus routes for the remainder of the round --- or as an alternative, forces everyone to form into buses with five members each.

**Discussion Questions**

The discussion following the game is quite possibly more valuable than the game itself. Be sure to discuss what happened after completing the game.

1. Can you think of a way to get around without spending a single Transportation Ticket?
2. What other Hubs would you add? What other Locations?
3. What effect does Telecommuting have on the game? How do you think we could use Telecommuting in real life to solve transportation problems?
4. How could you improve traffic flow around the room? Were there traffic jams? Dangerous commuters?
5. How does your community regulate traffic to keep everyone safe?

Activities from Other Sources

http://www.msnucleus.org/membership/html/k-6/as/benviron/3/asbe3_1a.html
Lesson plan for comparing various modes of transportation with a focus on electric energy

http://www.faa.gov/education research/education/student resources/kids corner/ Federal
Aviation Administration page with activities for kids

http://www.education-world.com/a sites/sites041.shtml teacher and
kid friendly sites for transportation

http://lessonplancentral.com/lessons/Science/Transportation/index.htm
transportation lesson plans for coaches/homeschooling/classroom use

http://www.med.yale.edu/chldstdy/parentsfirst/home schoolbridges/activities/Trucks%20
Trolleys%20Trains%20and%20Transportation.htm
Transportation activities you can do at home

# Smart Move Glossary*

**Accessible** – easy to approach, reach, enter, speak with, or use.*

**Bike share** – (also known as: Community Bicycle Program, Yellow Bicycle Programs, White bicycle programs, public bike or free bike) an increasingly popular system whereby bicycles are made available on a large scale in a city, allowing people to have ready access to these public bikes rather than rely on their own bikes. Municipal governments and community groups have promoted bicycle sharing systems as part of intermodal transportation by allowing people to shift easily from transit to bicycle and back again. By making alternatives to motorized travel easily accessible, they hope to reduce the carbon footprint of commuting as well as enable residents to become healthier through exercise (source: wikipedia.org).

**Carpool** – an arrangement among a group of automobile owners by which each owner in turn drives the others or their children to and from a designated place.

**Car share** – a model of car rental where people rent cars for short periods of time, often by the hour. They are attractive to customers who make only occasional use of a vehicle, as well as others who would like occasional access to a vehicle of a different type than they use day-to-day (source: wikipedia.org)

**Communication** – the imparting or interchange of thoughts, opinions, or information by speech, writing, or signs.

**Congestion** – overcrowding; clogging: *severe traffic congestion.*

**Cruise control** – a system, available for some automobiles, motorcycles, etc., that automatically maintains a vehicle's speed by taking control of the accelerator.

**Efficient** – 1. performing or functioning in the best possible manner with the least waste of time and effort; having and using requisite knowledge, skill, and industry; competent; capable : *a reliable, efficient secretary.*
2. utilizing a particular commodity or product with maximum efficiency (usually used in combination): *a fuel-efficient engine.*

**GPS** – Global Positioning System - A system of satellites, computers, and receivers that is able to determine the latitude and longitude of a receiver on Earth. It does this by calculating the difference in the time it takes for signals from different satellites to reach the receiver.

**GIS** – Geographic Information System - A computer application used to store, view, and analyze geographical information, especially maps.

**High-speed rail** - a type of passenger rail transport that operates significantly faster than the normal speed of rail traffic. While high-speed rail is usually designed for passenger travel, some high-speed systems also carry freight service. For instance, the French mail service *La Poste* owns a few special high speed trains for carrying postal freight (source: wikipedia.org).

**Hub** – a center around which other things revolve or from which they radiate; a focus of activity, authority, commerce, transportation, etc.: *Chicago is a railroad hub.*

**Infrastructure** – 1. the basic, underlying framework or features of a system or organization.
2. the fundamental facilities and systems serving a country, city, or area, as transportation and communication systems, power plants, and schools.

**Maglev** – Magnetic Levitation – 1. the suspension of an object above or below a second object by means of magnetic repulsion or attraction.

2. *Railroads*. the suspension of a vehicle above or below a suitable guide rail by such means, often with the vehicle being propelled by a linear induction motor.

**Mobile** – capable of moving or being moved readily.

**Mobility** – the quality of being mobile.

**Mode** – a manner of acting or doing; method; way: *modern modes of transportation.*

**Network** – 1. any netlike combination of filaments, lines, veins, passages, or the like: *a network of arteries; a network of sewers under the city.*
2. a system of interrelated buildings, offices, stations, etc., esp. over a large area or throughout a country, territory, region, etc.: *a network of supply depots.*
3. *Telecommunications, Computers*. a system containing any combination of computers, computer terminals, printers, audio or visual display devices, or telephones interconnected by telecommunication equipment or cables: used to transmit or receive information.

**Proximity** – nearness in place, time, order, occurrence, or relation.

**Rickshaw** – a small, two-wheeled, cartlike passenger vehicle with a fold-down top, pulled by one person, formerly used widely in Japan and China.

**Safety** – 1. the state of being safe; freedom from the occurrence or risk of injury, danger, or loss.
2. the quality of averting or not causing injury, danger, or loss.

**Smart Transportation** – Moving people, moving goods, and moving less overall in ways that are cleaner, greener, safer, healthier, more connected, and more equitable (Susan Zielinski of http://um-smart.org/)

**Sustain** – 1. To keep in existence; maintain.
2. To supply with necessities or nourishment; provide for.

**Sustainable** – Capable of being continued with minimal long-term effect on the environment: *sustainable agriculture.*

**Technology** – 1. the branch of knowledge that deals with the creation and use of technical means and their interrelation with life, society, and the environment. It draws upon such subjects as industrial arts, engineering, applied science, and pure science. 2. a technological process, invention, method, or the like.

**Telecommute** – To work at home using a computer connected to the network of one's employer.
Origin: tele- + commute

> **Tele** – a combining form meaning "distant," esp. "transmission over a distance," used in the formation of compound words: *telegraph.*

> **Commute** – to travel regularly over some distance, as from a suburb into a city and back: *He commutes to work by train.*

**Transport** – to carry, move, or convey from one place to another.

**Transportation** – 1. the act of transporting.
2. the state of being transported.
3. the means of transport or conveyance.
4. the business of conveying people, goods, etc.
5. price of travel or transport by public conveyance; fare.


\* Except where otherwise noted, these definitions were taken from dictionary.com. In cases where multiple definitions exist, we selected the one(s) that best suit the Smart Move Challenge.

# Smart Move Web Resources

**Transportation Security**

**Learn about Transportation Security**
Website created for FLL Teams, sponsored by the Department of Homeland Security (DHS) National Transportation Security Center of Excellence (NTSCOE)

**Careers, Professional Organizations, and Research Organizations**

**Official Kids' Portal to the US Government: Careers**

**American Society of Civil Engineers**

**University of Michigan SMART**
SMART undertakes research, demonstration projects, education, and global learning exchange on a range of issues related to the future of transportation in city regions around the world.

**Institute for Transportation & Development Policy**

**World Business Council for Sustainable Development Mobility Project**

**Transportation for America**

**Regional Planning, Sustainable Growth and Specific Examples**

**Some predictions about transportation in the 21st century based on interesting statistics** (such as age of population and internet access)

**Great information about factors considered in regional planning**

**Information about trends toward sprawl and urban clusters**

**The New Mobility Agenda**

**Reconnecting America**

**Specific Examples & Systems**

**Inspire Mobility blog**

**How the city of Boston uses various modes of transportation**

**Multi-modal transport hub at the Hong Kong International Airport**

Civitas
**European cities**

**Forms of Transportation**

**Rails West -studies the current status and history of U.S. railways**

**Information about sustainable transportation**

**smarttransportation.org**
Non-profit organized to increase the awareness and availability of clean technology in the transportation sector across the US. Site has a lot of information about hybrids and other alternative vehicles.

**Article about Smart Bikes and bike sharing programs**

**Specific Technologies**

**How Stuff Works: Maglev Trains**

**GPS**
An explanation of GPS from NASA

**How Stuff Works: GPS**

**Garmin**
Specific Garmin GPS devices

**Triangulation and how it is used**

**Tons of resources about GPS, transportation, and mapping**.
The format seems a little daunting at first, but contains lots of info about cool advances.

**Navigation**

**General Aviation**
Information on air navigation

**The possible future of air traffic control**

**Cartography**

**Online aeronautical charts**

# Team Marketing FAQ

Answers to common questions asked throughout the FLL season.

**Q: May we use the *FIRST* or *FIRST* LEGO League logo in our team promotional items/activities (e.g. t-shirts, pins…)?**

Teams are welcome to use the official *FIRST* or FLL logo in team promotional activities.  Please note that the*FIRST* and FLL logos are registered trademarks. Trademark protection does not allow the logos/trademarks to be altered, cut apart, or separated in any way. The logos may be resized, but must maintain the same proportions. If you have any questions regarding the use or depiction of a *FIRST* or FLL logo, please e-mail**marketing@usfirst.org** .

The logos and logo standards may be downloaded from the **FLL Communications Resource Center Graphics Section**. There are two versions of each logo - a standard version for use on a white or light-colored background (as shown on the page) and a reverse version (see "rev" in the filename) for use on a black or dark-colored background.

*FIRST* graphics may not be incorporated into any item for commercial sale without written approval from *FIRST*Marketing. Please e-mail requests to **marketing@usfirst.org**  and allow at least 2 business days for response.

**Q: May we use the FLL Challenge logo in our team promotional items/activities?**

Teams are welcome to use the FLL Challenge logo in their marketing/promotional activities.  You can download the logo files on the **FLL Communications Resource Center Graphics Section**. As with the *FIRST* and FLL logos, the logo may not be altered. Please adhere to the *FIRST* **Logo Standards**.

**Q: How do I obtain hi-res, vector-based artwork for the *FIRST* or FLL logo?**

You can download the logos and logo standards from the **FLL Communications Resource Center Graphics Section**.  See "For Print Applications" for hi-res, vector-based EPS files. Please adhere to the *FIRST* **Logo Standards**.

**Q: What are the colors and font in the *FIRST* logo?**

Detailed information regarding our logo specifications is available in our *FIRST* **Logo Standards** guide. The color specifications are covered on page LS-C14 and the wordmark lettering is covered on page LS-C01.

Additional Notes:
1)    Please do not use other colors on our logos.
2)    The *FIRST* wordmark should always be shown in italics. It should also include a superscripted registered trademark in the first instance on a page or document: *FIRST*[®]

**Q: Is hi-res FLL stock photography available?**

Yes, a selection of photos from past *FIRST* LEGO League World Festivals is available in the **FLL Communications Resource Center Photo Gallery Section**. You can download the images in either hi-res or low-res format. Photos should be credited to Adriana M. Groisman unless otherwise indicated beneath the image thumbnail. No team member names may be included with a photo without the express written consent of the student (if 18 or older) or the student's parent or guardian (if under 18).

**Q: May we use Dean Kamen's and/or Woodie Flowers' likeness in our team promotional activities (e.g. cardboard cut-outs, animations…)?**

Any use of Dean's or Woodie's likeness must be respectful and in conformance with *FIRST* values. Please e-mail requests including a detailed description or sketch/comp of your planned use to *FIRST* Marketing at**marketing@usfirst.org** and allow at least 2 business days for response.

**Q: Do you have any video tools available so we can show friends, family, potential sponsors, and others what *FIRST* and FLL are about?**

Yes, a selection of videos is available in streaming format on the online **FLL Communications Resource Center Video Clips Section**. You can also find a number of *FIRST* videos on our **FIRSTWorldTube Channel** on YouTube.

**Q: Do you have any brochures or flyers that we can use to promote *FIRST*?**

A: We appreciate teams' efforts to spread the word about *FIRST*.  With thousands of teams and volunteers all doing terrific work, we don't have the resources to support requests for quantities of materials.  However, what we have done to help is create materials that are specifically designed to be produced locally.  These include good quality 1- and 2-page fliers that address specific areas about *FIRST* and its programs, as well as PowerPoint slides for presentations.  These can be easily printed/reproduced locally in color or shared via e-mail. Please visit the **FLL Communications Resource Center** and check out the items in the Vision, Summaries and Facts, Impact, and Get Involved sections.

**Q: May we issue press releases about our participation in FLL (including awards announcements)?**

FLL teams are encouraged to issue press releases to local media about their participation and accomplishments in the *FIRST* LEGO League program. Team press release templates to announce **participation in an FLL event**  and **winning an award**  at an FLL event will available after the 2009 "Smart Move" Challenge is released. Simply edit the highlighted areas as appropriate.

**Q: Is it OK for our team to participate in media opportunities?**

Absolutely! Please work directly with your local or regional media to cover the team. If the media wishes to attend your event with you, please direct them to the local event organizer to obtain media credentials. Find the event organizer's name and e-mail address by **searching for the event on our website** and clicking on the event name in the results listing. If any team member under 18 years old is to be photographed or interviewed individually, please make sure that you have approval from a parent or guardian before doing the interview.

Please be sure to let *FIRST* Marketing know of any national media opportunities by sending an e-mail to**marketing@usfirst.org**.

**Q: Does *FIRST* have a Public Service Announcement (PSA) that I can ask my local broadcasters to air?**

Yes, a *FIRST* **Public Service Announcement** featuring actor Keanu Reeves is available in a broadcast-quality format.