FIRST LEGO League 2004 Challenge – No Limits

Many people have difficulty moving or walking, or trouble reading a distant sign or climbing stairs. In NO LIMITS, FLL teams will find ways to help people with different levels of physical ability.

2004 Theme:
In this year's challenge, FLL teams will find ways to help people with different levels of physical ability.

Premise:
The dream of a modern society is one of equal access for all. Society as a whole benefits when creativity, technology and open minds come together to help make that equality possible for all people, regardless of physical differences.

Focus:
Many people have difficulty moving or walking, or trouble reading a distant sign or climbing stairs. The 2004 FLL Challenge is to examine these seemingly simple tasks in a new light and explore how technology and human thought can work together to create equal access for all people.

2004 Challenge:
Each FLL team will build and program a robot that addresses the specific needs of people who face physical challenges in today's society. Teams will research and present robotics technology solutions to help individuals in their community perform the everyday actions that many people today take for granted.

Robotic Missions

Read This First

After reading and printing the "Missions & Scoring" page, every year some teams just jump right into building and programming without giving equal attention to the many important details in the other pages. These teams experience unneeded confusion and frustration, and are often unpleasantly surprised at tournaments. To avoid all that and maximize your team's performance, please invest the time needed read ALL of the pages, and refer back to them often.

Field Setup

Important. See Q&A for oversized mats

OVERVIEW: The Challenge Field is an obstacle course on a mat. The obstacles are called "Mission Models", and the mat is called the "Field Mat". Some of the models are secured using 3M "Dual Lock" fastening material. The mat must be on a smooth flat surface, and it must be surrounded by border walls to contain all the action.

Requirements: This step first requires that you…

- have read and followed the instructions under "Surface & Borders" so you now have an official framework on which to stage your field.
- have read and followed the instructions on the CD that came with your Field Setup Kit so you now have the LEGO Mission Models.
- have the Field Mat and Dual Lock fastening material that came in your Field Setup Kit.

Field Mat Placement

Step 1: Clear any and all debris off the surface you intend to put the mat on. Even the tiniest particle under the mat can give the robot trouble. So vacuum the surface if you can, and run your hand over the surface afterward. Get rid of any protruding imperfections you find.

Step 2: Unroll the mat and position it so the image is up and the ball court is near the Dummy Border at the back of your framework. If the mat won't fit between the border walls, take the time to move the walls as needed. If there's interference in just one small spot due to imperfection in the border, then it's okay to trim the mat in that area only.

Step 3: Slide and align the mat so that there is no gap between the "Base" corner's edges of the mat and the corresponding borders. Gaps are acceptable at the other 2 edges unless they approach 3/8 inch (10mm), in which case you should move the borders.

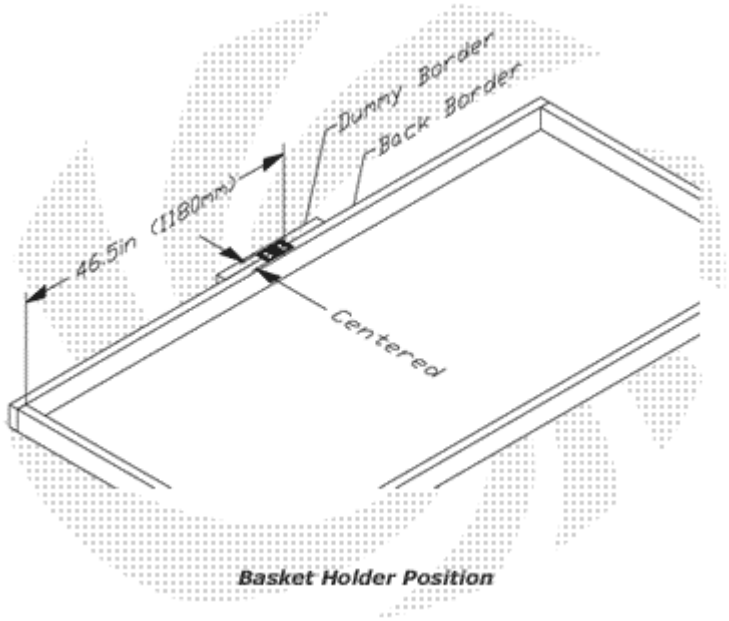
Step 4: With help from another person, pull the mat at opposite ends, then massage out any waviness from left to right and re-check the requirements of Step 3. It is expected that some waviness will persist, but it should relax over time.

Using Dual Lock

Dual Lock is designed to stick to itself when two faces of it are pressed together. Wherever Dual Lock is called for, stick one square on the location, adhesive side down, and then press another square onto the first one, face to face, adhesive side up (pulling fingers away will take practice!). Finally, line the model up over it's location, lower it, and press it down onto the Dual Lock. Using this technique avoids the need to guess where to place Dual Lock on the model.

Mission Model Placement

Basket Holder & Basket
Basket Holder and Basket: MEASURE ALONG THE BACK BORDER WALL (NOT THE MAT) TO FIND THE MIDPOINT BETWEEN THE LEFT AND RIGHT BORDER WALLS. This point should be very close to 46.5 inches (1180mm) from the inside of either wall. Use 8 pairs of Dual Lock squares to secure the Basket Holder AT THAT MIDPOINT as shown in the diagram labeled Basket Holder Position. Place the Basket on the Basket Holder, making sure it's trapped between the little orange cones. Note: WHEN THE BASKET IS LOCATED CORRECTLY IT WILL NOT LOOK CENTERED WITH THE MAT. Do not try to center the Basket assembly by looking at the ball court.



Dog and Cat
With these pets facing each other, use 8 pairs of Dual Lock squares, one for each paw, to secure them to the mat on their location marks on the red brick patio.

Gate
Noting the correct side for the hinge as shown on the mat, use 8 pairs of Dual Lock squares to secure the Gate to the mat on its location marks at the far right. To ensure proper function of the Gate, check the distance between the outer sides of the tan frame near the bottom. Adjust as needed to make this distance fall within 10-1/16 to 10-1/8 inches (255 to 257mm). Also, make sure all of the Gate's axle and pin connections are as tight as possible. When swung open, the Gate should swing freely and lock open.

Fence
Noting the correct side for the Fence rails as shown on the mat, use 8 pairs of Dual Lock

squares to secure the Fence to the mat on it's location marks at lower left of the red brick patio.

Stairs
With the railing toward the pond, use 10 pairs of Dual Lock squares to secure the Stairs to the mat on their location marks at the right of the ball court. Be sure to put a Dual Lock pair at or near each of the extreme corners.

Sign Holders and Signs
Place 3 custom-cut pairs of Dual Lock rectangles as shown in the diagram labeled Signs to secure these models to the top inside of the border wall. Make sure to center each assembly directly above one of the BUS labels on the mat. It does not matter which position the white assembly occupies. After each sign holder and sign are Dual Locked in place, swivel the Sign Holder's upper beam 90 degrees to help keep the sign in place.

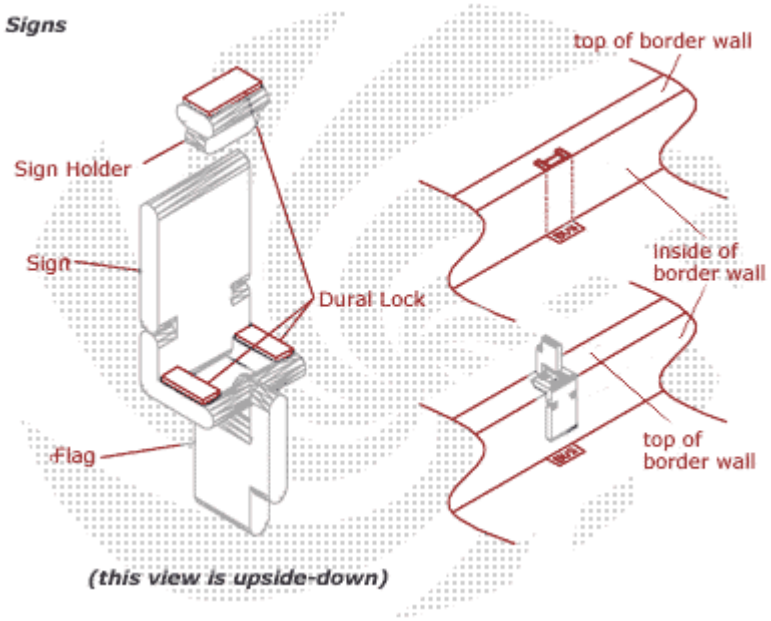
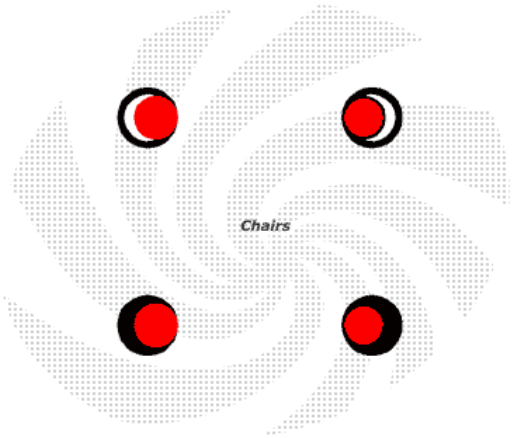


Table
Use 4 pairs of Dual Lock squares to secure the Table to the mat on its location marks on the oval rug.

Chairs
The 3 Chairs are NOT secured to the mat. Just place them over their location circles near the oval rug, such that the back of each Chair is on a black circle. The exact correct placement of each Chair is with the right-to-left inside extremes of the Chair's legs (shown in red) touching the corresponding inside extremes of the circles on the mat, as shown in the diagram labeled Chairs.



CD Holder
Use 4 pairs of Dual Lock squares to secure the CD Holder to the mat on it's location marks near the desk. Find a useless CD and place it upside-down over the cone on the CD holder.

Glasses
These are not secured to the mat. Just place them on their location marks near the keyboard. The lenses of the Glasses go on the cross-shaped marks. The black band at the bottom of each lens gets centered on its cross. The earpiece ends get centered between their v-shaped marks.

Bowl of Food and Tray
These are kept in Base (not secured to the mat), wherever the team wants to store them before hand loading them onto the robot for a mission, but the Food should stay in the Bowl.

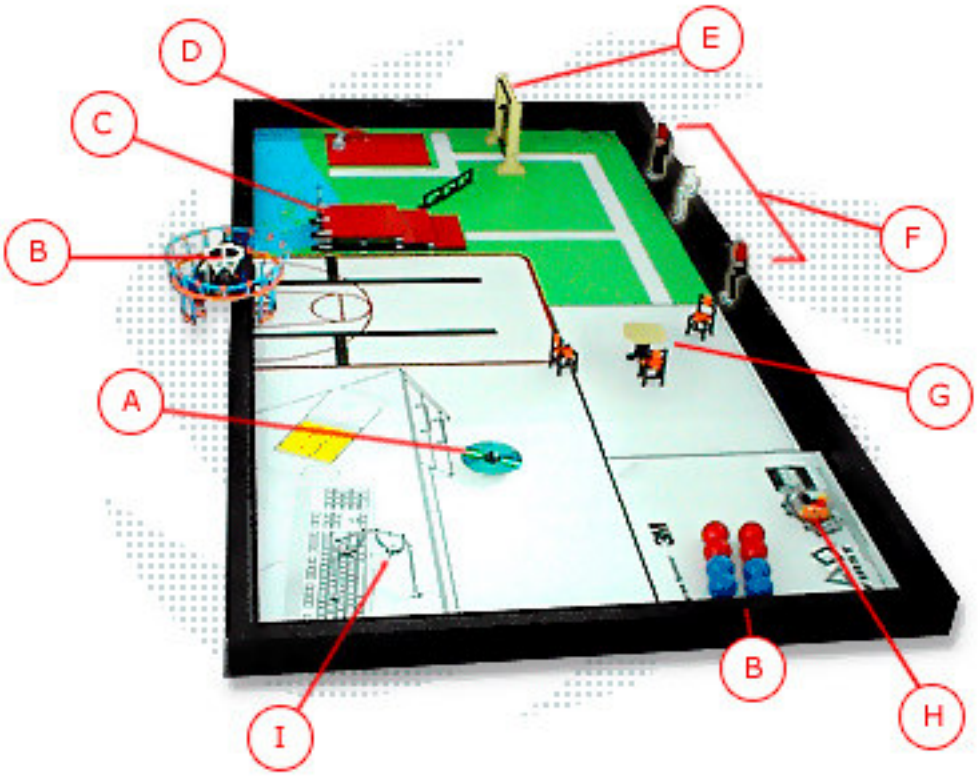
Pet Food
The 3 black pieces of Food will be used as pet food. They should be separated from the rest of the food and kept in Base (not secured to the mat) wherever the team wants to store them before hand loading them onto the robot for a mission.

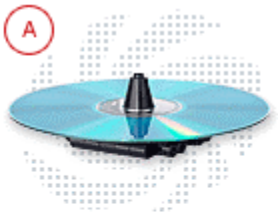
Ball Holders and Balls
These are kept in Base (not secured to the mat), wherever the team wants to store them before hand loading them onto the robot for a mission, but the Balls should be kept in their holders prior to leaving Base.

Maintenance

Keep the models in original condition by straightening and tightening them often. Though some models are fragile, do not rely on their destruction for your strategy, as some may be glued together at a tournament. Avoid cleaning the mat with anything that will leave a residue. Try a damp cloth, and a pencil eraser for tough marks.

MISSIONS



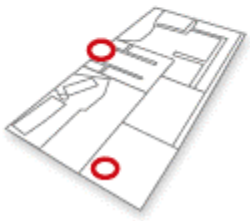


Put the CD away

40 Points (Full)

35 Points (Partial)

The Robot must move the CD so that it touches the CD case for full points, or the top surface of the desk for partial points.



Play ball

5 Points (Each Ball in Your Side of Basket)
50 Points (Your Ball in Center Ring)

The Robot must move Balls into the Basket. Balls in your side of the Basket from either team are worth points to your team only. Your color Ball in the center ring is worth points to your team only. The Robot can only leave Base with one Ball at a time and each of the 8 Balls can only leave Base once. Balls which have never left base must be kept in their Holders, and used/stray Balls must not be returned to their holders.

BONUS: 2 Points Each

Any balls on your side of the Field that are NOT in the Basket are worth points as Bonus Objects whether or not they're in Base, and only these Balls are subject to the Bonus Loss rule. Balls which have not yet left Base will be taken in preference over others.

Climb the stairs

45 Points (Full)

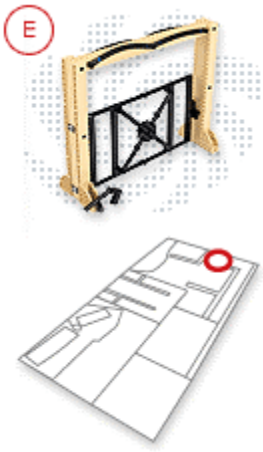
40 Points (Partial)

The Robot must move itself onto the stairs and remain completely off the mat until the match ends. For full points, the Robot can only be touching the top step and the rail. For partial points, the Robot can be touching the lower steps. No points are earned if any part of the Robot is touching the mat.

Feed the pets

15 Points (Each Piece of Food)

The Robot must move the three black pieces of Food from Base to the red brick patio. The Food can not be covered from above, and no points are earned if either pet comes off the patio.

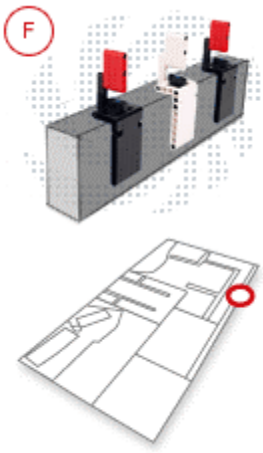


Open the gate

35 Points (Full)

20 Points (Partial)

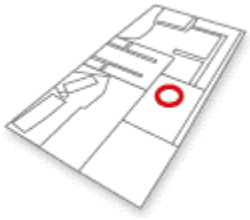
The Robot must open the Gate so that it’s locked open by its retaining hook for full points. Opening the Gate partially is worth partial points.



Read the bus route signs

35 Points

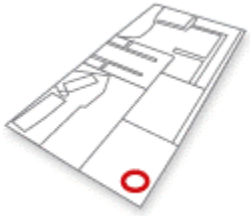
The white BUS route Sign will be randomly switched with one of the two red & black Signs before each Match. The Robot must clearly deflect the white Sign's flag only. No points are earned for this Mission if either red flag is deflected.



Push in the chairs

10 Points Each

The Robot must move each Chair as needed so that all four legs touch the oval carpet. Chairs that are knocked over are not worth points.

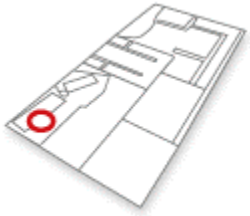


Serve dinner

<P45 Points (Full)

35 Points (Partial)

The Robot must move the Food from Base onto the dinner Table. For full points, the Bowl must stay on the Tray, and all the Food must stay in the Bowl. For partial points, only the Bowl with some Food in it needs to be delivered. In either case, no additional parts can be combined with the delivery to secure or contain it.



Remove the glasses

40 Points

The Robot must move the Glasses to Base.

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Rules

2004 FLL TOURNAMENT TERMS & RULES

READ THIS FIRST: To maximize performance and eliminate surprises, the team must take the time to read and understand FOUR documents: The Field Setup Instructions, the Missions & Scoring, the Tournament Terms & Rules, and the current Questions & Answers page on the web.

PRECEDENCE: When there is conflict between the wording of a Mission and a Rule, the Mission takes precedence. The current Questions & Answers page on the web takes precedence over all other Challenge documents.

CHALLENGE QUESTIONS: For official answers to questions about any aspect of the robot game part of the Challenge, including advance rulings on special strategies or situations, e-mail flltech@usfirst.org (most efficient) or call1-800-871-8326, x118 (less efficient). When e-mailing, be sure to put "Challenge" in the subject line, and please state your role on the team (member, coach, parent, mentor).NOTE: flltech does not answer questions about building or programming the robot. NOTE: The FLL International Forum is great for sharing ideas, opinions, and tips, but it is not a reliable source of correct answers about the Challenge.

MATERIALS: The robot, its attachments, accessories, and all other Strategic Objects brought to a Match must be made entirely of LEGO elements in original factory condition. Electrical parts are limited in type and quantity to 1 RCX, 1 Rotation Sensor, 2 Touch Sensors, 2 Light Sensors, 3 Motors, 1 Lamp, and 6 AA batteries. Stickers, paint, tape, glue, oil, etc. are not allowed, except marker can be used for owner identification in hidden areas only.

SOFTWARE: The robot must be programmed using LEGO MindStorms Robotics Invention System or RoboLab software (any version).

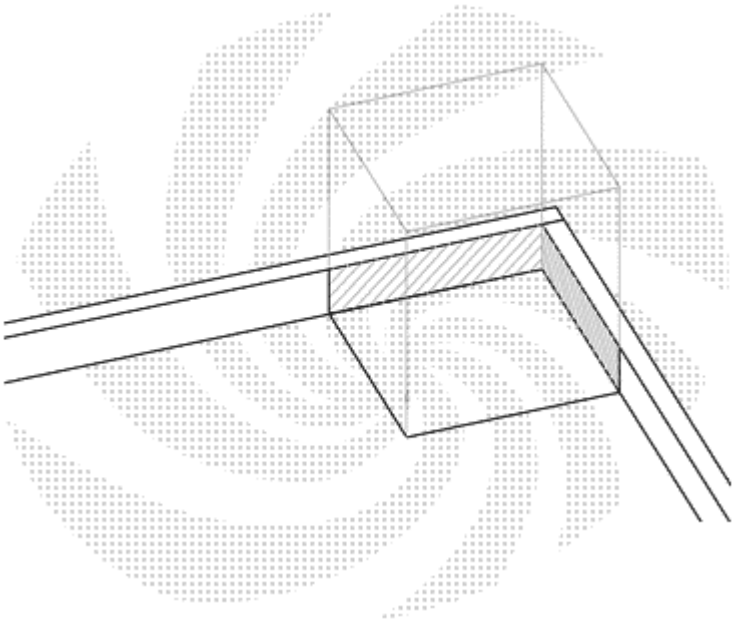
DOWNLOADING: One team's download can erase another team's programs and ruin their performance. Therefore, downloading is only allowed in the pit area, download settings must be kept on short range, the process must be shielded from surrounding teams, and the RCX should be kept OFF when not in use.

PARTICIPATION: Only two team members at a time are allowed at the field except during repair emergencies. To share in participation, members can switch out with each other between Mission Attempts.

MATCH: At a tournament, two Challenge fields are joined back to back, and each team is paired opposite another to compete in a Match. For 2-1/2 minutes, the robot tries to earn the best score it can by completing Missions. The timer never pauses during a Match. Each Match is a fresh chance for a team to earn it's best score, and no Match has anything to do with another.

ROUND: The process of cycling all the teams through one Match each is called a Round. Most tournaments run at least 3 Rounds, and teams have plenty of time between their Matches to go to the pit area and work on the robot and its programs as needed.

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



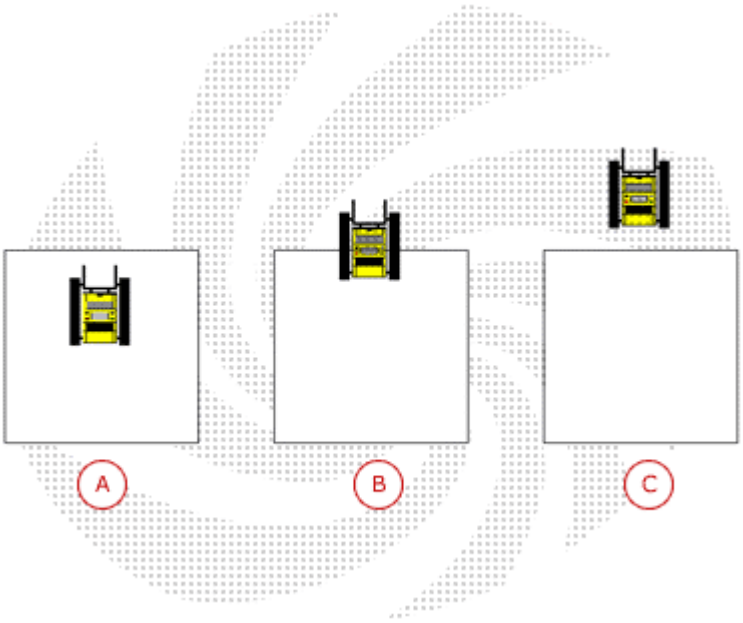
USE OF HANDS IN BASE: Before the start, and only when the robot is completely in Base during the Match, the team is allowed to make repairs, add or remove parts, load Strategic Objects or Deliverables, unload Retrievables, set mechanisms, select programs, aim the robot, interact with sensors, and press buttons.

MISSION: A Mission is a job the robot can complete for points. Missions can be attempted in any order, alone or in groups, re-attempted when possible, or skipped. Points are earned if the required results on the field are still visible at the end of the Match.

STARTING POSITION: At the beginning of the Match, and for all Restarts, all portions of the robot and it's currently used attachments, Strategic Objects, and Deliverables must start from completely in Base as shown in the diagram labeled Robot Position.

Robot Position

A: Completely in Base
B: Crossing IN or OUT
C: Completely OUT of Base



STARTING TECHNIQUE: The team can start the robot by pressing a button, signaling a sensor, or simply letting go of it while it's running, but the team must no longer be touching the robot as it starts crossing out of Base.

HAND FORCE: The team is not allowed to push, roll, slide, or throw the robot or anything else out of Base.

AIMING: Alignment devices can be used to help aim the robot in Starting Position, but they must be made from the allowable Materials, and they must stay completely in Base.

ROBOT MUST LEAVE BASE: The robot must leave Base at least partially before it is allowed to do anything except travel and transport. Any changes made to the field before the robot starts crossing out of Base will be undone by the referee.

FORCED RESTARTS: Every time the robot is touched, it must immediately be returned to Starting Position unless it is already there.

RETURNING TO BASE: Except for Forced Restarts, the robot does not have to return to Base unless the team wants to handle it or unless a Mission requires it.

BONUS LOSS: If the robot is touched while completely out of Base, the referee removes one Bonus Object from the field if there are any available at that time. If the robot is touched while crossing in or out of Base, there is no Bonus Loss.

DELIVERABLES/RETRIEVABLES: Deliverables are objects which are worth points when moved to a place outside of Base. Retrievables are objects which are worth points when moved to Base.

DELIVERABLES, ROBOT TOUCHED: If the robot is touched while in contact with a Deliverable, the team gets the Deliverable back in Base for another try.

DELIVERABLES, POINTS: Points for a Deliverable are given as long as some portion of that Deliverable is at its destination, whether or not it is packaged or joined with others.

RETRIEVABLES, ROBOT TOUCHED: If the robot is touched while in contact with a Retrievable which has not reached Base and the object stays with the robot when carried to Base, the referee keeps that object off the field and it is not worth points. If the objects stays on the field, it is covered under the Loss Of Contact and Stray Objects rules.

RETRIEVABLES, POINTS: Points for a Retrievable are given only if the robot gets some portion of that object to reach Base.

LOSS OF CONTACT: When the robot loses contact with a Deliverable, Retrievable, or Strategic Object, the team cannot get that object back by hand.

STRATEGIC OBJECTS: Strategic Objects are team-supplied objects which the robot leaves on the field by design.

STRAY OBJECTS: Any object caused by the robot to be in the way of future Missions can be removed from the field by the referee upon team request unless doing so would have a direct effect on scoring.

ROBOT DAMAGE: At any time during the Match, the team can recover robot parts that come off as an obvious result of unintentional damage or disintegration. The team can do this by hand or request help from the referee.

FIELD DAMAGE: Changes in the field are never restored by hand for the sake of giving the team "more tries". However, if a Mission model breaks, malfunctions, or is moved or

activated by anything other than allowable robot action, the referee reverses the problem as soon as possible and gives the team the benefit of the doubt if points are in question. If it is obvious to the referee that intentional field damage is part of team strategy, no points are awarded for related Missions.

SCORE DETERMINATION: To minimize controversy about what happened during a Match, THE SCORE IS DETERMINED AT THE END OF THE MATCH, BY THE CONDITION OF THE FIELD AT THAT TIME ONLY. This means that points are not awarded for accomplishments that the robot accidentally trashes before the Match ends.

BENEFIT OF THE DOUBT: In situations that too close to call, such as when a split-second or the thickness of a line is a factor, and in situations where a result can be soundly argued to two opposite conclusions, the team is given the benefit of the doubt.

AFTER THE MATCH: The referee and the team look at the field together and come to agreement about what points were earned or missed and why, and to be sure that the team is not walking away with any Mission Models.

Questions & Answers

It is very important for your team to keep checking back to this page often, since it will be updated as needed. The answers, clarifications, and early rulings found here are official, and will be applied at tournaments.

Stairs 9-15-04

Q: On the stairs mission, do we have to be all the way at the top only, or is okay to still have part of the robot on the lower steps?

A: The steps count as part of the stairs.

CD 9-15-04

Q: Does the CD need to be touching the circle part of the CD case for points?

A: No. You'll get credit as long as the CD is touching anywhere at all on either side of the case.

Chair 9-15-04

Q: Are there free points for the chair that's already on the rug when the match starts?

A: Yes, as long as it still meets the requirements at the END of the match.

Bus signs 9-15-04

Q: Can you define "deflect" where it talks about hitting the white flag?

A: When the field is set up, the flag is perfectly upright. For you to get credit for hitting the flag, the referee must simply see that the flag is leaning one way or the other, even if it's only a tiny bit.

The Project

FLL is more than just building and competing with robots. This year, your team will take on many important roles.

Be detectives: Decide whether or not your school or community is accessible to people with physical disabilities. Be inventors: Make your environment easier for everyone to use by designing a clever invention to assist people with disabilities. Marketing experts: Raise awareness in your community by sharing everything you learned.

IMPORTANT !
Before starting on your research assignment, please read the following documents.

Story – Late for Lunch

http://www.firstlegoleague.org/sitemod/upload/Root/images/2004Challenge/Late_For_Lunch_FINAL.doc

Project Guide 2004

http://www.firstlegoleague.org/sitemod/upload/Root/images/2004Challenge/Research_Assignment_v4_US.pdf

Resources

Sensitivity & History
Disabilities curriculum from San Mateo (CA) schools
:: www.co.sanmateo.ca.us

Disability History Project - timeline
:: www.disabilityhistory.org

Dr. Stephen Hawking
:: www.hawking.org.uk

Guidelines for Non-Handicapping Language
:: www.apastyle.org/disabilities.html

History of the Independent Living Movement
:: www.acils.com
:: http://bancroft.berkeley.edu/collections/drilm/

Site created by a young adult
whose younger brother was diagnosed with a form of arthritis
:: www.asiblingssite.com

Information about Specific Disabilities

Questions kids ask about blindness
:: www.nfb.org

Health Issues that Affect Kids
:: kidshealth.org

National Institute on Deafness and Other Communication Disorders
:: www.nidcd.nih.gov

Many, many resources
for children with disabilities and the people who care for them
:: www.irsc.org

Inventions & Technology

Use of Artificial Muscles
:: www.jpl.nasa.gov

New robotic legs could produce an army of super troopers
:: www.msnbc.msn.com

Leg replacement
Norwegian man opts for "osseointegration," a procedure featuring a titanium pin in the prosthesis that will replace the leg he lost in a hunting accident.
:: www.pbs.org/wnet/innovation/flash/ep2_flash.html

Metal leg
From the most sophisticated metal leg prostheses to jaw-dropping artificial vision systems and astonishing advances in the translation of brain signals
:: www.pbs.org/wnet/innovation/episode2_essay1.html

Bionics may one day help the blind see
:: www.pbs.org/saf/1107/

Controlled by the mind
When you can sail a boat, fly a jet or move a computer's cursor around the screen just by thinking about it. In fact, Junker himself already can.
:: http://www.pbs.org/saf/1107/segments/1107-5.htm