FIRST ® LEGO® League (FLL ®)

Introduction For Coaches

Tony Ayad and
LeRoy Nelson

Outline

FIRST LEGO League

- Teams & Requirements
- The Annual Challenge
- Competition and Judging
- Progression
- Season Calendar
- Expectation
- Tips

Basic Programming

- NXT Controller (aka: the "brick")
- NXT-G Interface
- MOVE, MOTOR & ROTATION SENSOR Blocks
- Turns
- Applying Math & Geometry concepts

FIRST®

- For Inspiration and Recognition of Science and Technology
  - It is about encouraging kids to learn about Science, Technology, Engineering and Math (STEM) through a robotic game
  - Founded by Dean Kamen, inventor of the Segway
- FIRST® Robotics Competition (FRC®)
  - Winter advanced robotics program for high school students
- FIRST® Tech Challenge (FTC®)
  - Fall basic robotics program for high school students
- FIRST® LEGO® League (FLL®)
  - Fall robotics and research program
  - 20,000 Teams of 2-10 young people 9-14 years old in 50+ countries
- Junior FIRST® LEGO® League (Jr.FLL®)
  - Primarily fall research program for teams of 2-6 children 6-9 years old

FLL Core Values

- We are a team.
- We do the work to find solutions with guidance from our coaches and mentors.
- We know our coaches and mentors don't have all the answers; we learn together.
  - New for 2011
- We honor the spirit of friendly competition.
- What we discover is more important than what we win.
- We share our experiences with others.
  - Reinforce what they learned, improve presentation skills, especially to adults
- We display Gracious Professionalism® and Coopertition® in everything we do.
  - Work like crazy, but treat one another with respect and kindness.
- We have FUN!

Team Requirements

- Team Size
  - Ideal size is 4-7 kids with one coach and one robot set
  - Larger teams may need additional mentors and/or additional robot sets
- Where to meet
  - Safe area large enough for the number of kids on the team
    - Classroom, garage, large living room or family room
  - Field table (4'X8') and a computer
    - Laptop computer preferred, so you can take it to events
    - Internet access preferred for research
  - Storage space for the field setup kit, robot set and robot (between meetings)
  - For first year team, one robot set is enough
- Snacks: Have parents bring snacks to get/keep them involved

Team Leadership Roles

- Purchaser
  - Secures funding from sponsors, parents, parents' employers
  - Registers the team and the coaches
  - May also be the coach
- Coach
  - Must be an adult
  - Organizes the team and meetings and ensures the team is progressing
  - Serves as a good role model and instills team spirit
  - You don't have to be an engineer to be a great FLL coach
- Assistant Coach (optional)
- Mentor (optional)
  - Technical person to explain engineering and programming concepts
- Remember that the kids do the work!
- Although one person can do everything, get help!

The Challenge

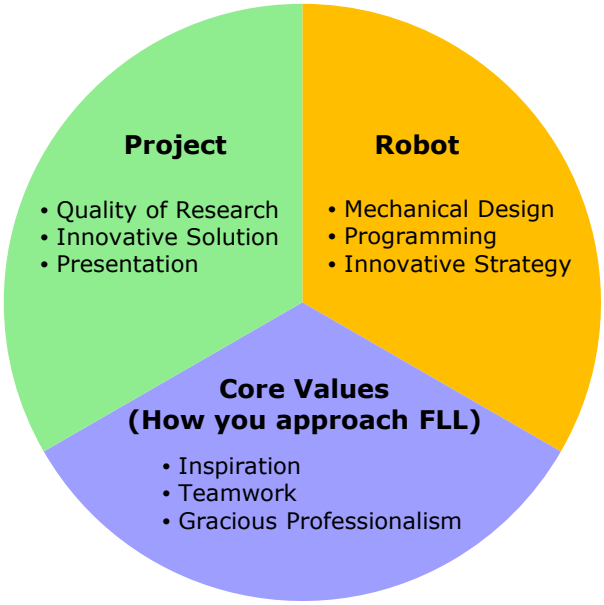
- Includes a robot game and a research project
- A different scientific or engineering theme every year
- Real-world community-based problems and solutions
- Stresses creativity and teamwork
- Teams use engineering processes: define problem, requirements, alternatives, solution, plan, presentation, …
- Multiple roles are needed: designers, builders, programmers, researchers, presenters, …
- Timing:
  - Team registration from early May through late September
  - Challenge released in early September on http://www.usfirst.org/
  - Season ends for most teams in November or December

2011 Food Factor Challenge: Keeping Food Safe

Can FIRST® LEGO® League teams improve the quality of food by finding ways to prevent food contamination? In the 2011 Food Factor Challenge, over 200,000 9-16* year olds from over 55 countries will explore the topic of food safety and examine the possible points of contamination our food encounters – from exposure to insects and creatures, to unsterile processing and transportation, to unsanitary preparation and storage – then find ways to prevent or combat these contaminates. In the Food Factor Challenge, teams will build, test, and program an autonomous robot using LEGO® MINDSTORMS® NXT to solve a set of Food Safety missions as well as research, develop, and share their innovative food safety solutions. Throughout their experience, teams will operate under FLL's signature set of Core Values.

* 9-14 in the US and Canada

Competition and Judging Elements: New Criteria



Core Values (How the team works on the Challenge)

- **Inspiration**
  - **Discovery**: Maintain appropriate balance among Robot, Project and Core Values
  - **Team Spirit**: Enthusiasm, fun and team identity
  - **Integration**: Application of FLL values outside FLL
- **Teamwork**
  - **Effectiveness**: Problem solving and decision making
  - **Efficiency**: Roles and time management
  - **Kids do the work**: Balance between team responsibility and Coach guidance
- **Gracious Professionalism**
  - **Inclusion**: All team members participate and help each other
  - **Respect**: Each team member feels valued when solving problems
  - **Coopertition**: Friendly competition

Project

- **Research**
  - **Problem Identification**: Clear definition of the problem being studied
  - **Sources of Information**: types and quality of sources including experts
  - **Problem Analysis**: Depth to which problem was studied and analyzed
  - **Review Existing Solution**: see what solutions are available
- **Innovative Solution**
  - **Team Solution**: clear explanation of the proposed solution
  - **Innovation**: Degree to which the team's solution makes life better
  - **Implementation**: Consideration of factors for implementation
- **Presentation**
  - **Presentation Effectiveness**: message delivery and organization
  - **Creativity**: Imagination used to develop and deliver the presentation
  - **Sharing**: Degree to which the team shared presentation with others

Robot

- **Mechanical Design**
  - **Durability**: Structural integrity
  - **Mechanical efficiency**: economic use of parts and time; easy to repair and change
  - **Mechanization**: Move with appropriate speed, strength and accuracy
- **Programming**
  - **Programming Quality**: Appropriate and achieves results consistently
  - **Programming efficiency**: Modular, streamlined and understandable
  - **Automation/Navigation**: Moves or acts as intended using mechanical or sensors feedback
- **Strategy and Innovation**
  - **Design Process**: Alternatives, selection, testing, improvement cycles
  - **Mission Strategy**: Clearly defined and described
  - **Innovation**: Unique or unexpected beneficial features

Core Awards Based on Judging Elements

- **Robot Performance Award:** highest robot performance scores
- **Judged Awards** (only one per team):
  - **Mechanical Design Award**
  - **Programming Award**
  - **Strategy and Innovation Award**
  - **Research Award**
  - **Innovative Solution Award**
  - **Presentation Award**
  - **Inspiration Award**
  - **Teamwork Award**
  - **Gracious Professionalism Award**
  - **Champion's Award:** best overall team in all areas
- Some awards may be combined for small events

FIRST Lego League Competition Progression

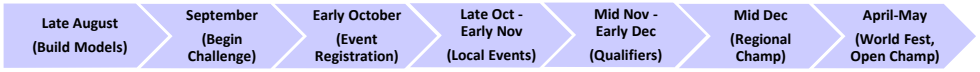
April, 2012
60 regions selected by lottery plus 24 Core Values teams selected to participate in WF

December, 2011
1st Place Champion's Award team advances to World Festival, 2nd Place to Open

November, 2011
The top 20-30% of the teams advance to the Regional Championship Event

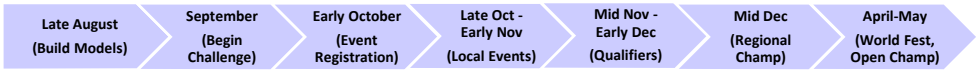
NOTE: You must select the region where you want to compete, before registering for the Qualifying Tournament.

FLL Season Calendar



- Late August (when the Field Setup Kit arrives)
  - Start building the mission models
  - Review the FLL Coaches' Handbook
- Early September (when the Challenge is released)
  - Attend a Release Workshop http://fll.larobotics.org/Events.html
  - Read the research project requirements carefully
  - Brainstorm research area and pick 2 or 3 ideas; identify experts
  - Read the game rules, mission descriptions, and field setup rules CAREFULLY; everyone understands!
  - Get help to clarify understanding http://forums.usfirst.org/forumdisplay.php?f=24
  - Develop game strategy by brainstorming; plan and "act" the missions

FLL Season Calendar



- September – October
  - Choose team name and T-shirts to wear to events
  - Complete the programming
  - Complete the research, solution developed, presentation style selected
- Early October
  - Sign up for a Local Event (optional, but highly recommended)
  - Sign up for a Qualifying Tournament
- Late October
  - Participate in Local Event
- November
  - Get ready for QT by refining project presentation, sharing what you learned, improving the programming of the robot

Expectations

- It takes a lot of time to complete the research project, to design, build and program the robot, and to practice for the competition
- Rookie teams should plan on meeting at least 4 hours per week
- Team members should work on the project as homework at least 1 hour per week
- 40-60 hours total over 10-12 weeks in September - November
- Discuss with parents to ensure they understand the commitment
- One or two kids may drop out, so have a backup plan
- Divide and conquer
  - Everyone may not program or build, but
  - Everyone needs to do their share of the research project and
  - Everyone needs to participate in developing the robot game strategy

Running Team Meetings

- Work with team members to come up with rules for your team at the first meeting
- Review team calendar with team (and parents) in early September
- Have the kids set goals for each meeting (5-10 minutes)
- Help create sub teams to organize the work
- Have the kids assign tasks to each person or sub team
- Review progress at the end of each meeting
- Assign tasks to be done between meetings
  - Project tasks (research and presentation) are good candidates
- Challenge the team and ask probing questions to guide the kids to their own answers instead of telling them your ideas
- Be aware of team dynamics to minimize cliques, conflicts
- Leaders will emerge!

Tips – Project

- Read the description carefully as a group and perform preliminary research to pick a specific project topic
  - When in doubt, read and re-read … and get help!
- Meet with experts as soon as possible to understand the issues and areas where the team may decide to focus / select a specific project
  - Since the topic this year is about food safety, chefs, food packagers, food shippers, moms or dads who cook, might be candidates. If you know any, let them know that the team might want to talk to them
- Most of the project work can be done outside the team meetings
  - Save meeting time for shared understanding and brainstorming ideas
  - Ensure that each team member is assigned a share of the work
  - All kids need to participate in the research, creation of props, charts, models, etc.

Tips – Project

- Plan on completing the research within 6 weeks
- Allow at least 2 weeks for preparing the presentation and practice
- Pick a presentation style that is suitable for the team and entertaining for the judges
  - Judges like to see and hear the kids perform live, not watch videos or PowerPoint presentations
- Since hearing can be a problem for some venues and for some judges, make sure all of the major presentation points are presented visually as well as spoken
  - Give the judges a printed summary of the presentation
- Keep the setup simple, because setup time counts as part of your presentation
  - Judges can see a laptop screen as well as a projection screen

Tips – Robot Game Preparation

- Study the Missions, Field Setup, **Rules** and Rulings carefully as a team
  - Review them every few weeks
  - If in doubt, check the Forum and submit questions to get answers
  - Check for posted Game Rulings at least weekly.
    - Rulings sometimes change the rules significantly
- Check the placement of the mat and missions on the field table per the Rules and Field Setup before practice or programming
- Make sure the battery is fully charged before each meeting
- Remember the KISS rule: Keep it simple, silly
  - There is limited time available to design, build and program the robot

Tips – Robot Game Strategy

- Develop a **strategy** for maneuvering the robot on the field that maximizes the number of points yet is simple enough to complete consistently within 2½ minutes
  - ALL team members should participate in this activity
  - Help the team set the right expectation and **not** plan on programming ALL the missions
  - Start with the easy missions and make sure they are done consistently before going on to harder missions
- Group missions in same field area to reduce the number of trips
  - Look for clear paths
  - Plan each trip by measuring the distance traveled to each turn
  - Plan and divide the work among individuals or sub-teams
  - Review the plan before the kids start programming to reinforce the “planning” concept

Tips – Robot Design

- Robot base
  - Balance most of the robot's weight on the drive wheels
  - Use rechargeable battery and recharge if voltage falls below 7.9 volts
  - Caster wheel warning: great for turning, horrible at aligning
- Arms, attachments and mechanisms
  - Plan for deviations when building attachments: make them wider
  - Combine functions of attachments to minimize exchange time and returns to base
  - You have only one motor to power all attachments and mechanisms
- General
  - The simpler the better to accomplish the missions
  - Have the team review robots on YouTube to get ideas
    - Search: *FIRST* LEGO League
  - Review and make sure components do not come apart after a few trials

Tips – Programming

- Verify that all files are backed up before programming starts!
- Save programs often; save working programs with special names
- Do not program when battery charge is below 7.9 volts
- If the robot can execute a program successfully 3 times in a row, it is done (the coach is the arbiter)
- Add comments to the programs to describe what blocks do and why
  - E.g., "Turn right to face the base"
- If possible, design programs so that the robot always starts from the same position in base to eliminate confusion during competition
- Accept this fact: The more turns and movements in a program, the more deviations will occur!!!
  - Use the field table borders or missions models to re-orient the robot
  - Use sensors

Resources

- FLL Coaches' Handbook – One copy sent to every registered team
- Los Angeles Region FLL New Teams web page: http://fll.larobotics.org/NewTeams.html
  - Teams
  - The season
  - Links to the official FLL websites
  - Team costs
  - Team grants
  - First steps for new teams
- Los Angeles Region FLL Team Resources web page: http://fll.larobotics.org/Resources.html
  - Recommended books
  - Links to many other resources
  - Forms for tournaments
  - Team Google group
  - Coach training workshops and robotics summer camps
- Coach Calls – See the FLL Team Resources Page: http://www.firstlegoleague.org/challenge/teamresources