

# **Introduction to LEGO® Robotics and MindStorms Software**

**Fall 2008  
8:30-3:00\***

**Presented by Maine Robotics  
167 Bennoch Road  
Orono, ME 04473**

**Tom Bickford, Instructor**

**\*Check website for finalized dates,  
locations, and times**

## **Agenda:**

1. Welcome and Logistics:
2. Background on Robotics
3. Building your first robot
  - a. Treaded robot
  - b. Wheeled robot
4. Working with the software
  - a. RoboLab (RCX)
  - b. MindStorms (NXT)
5. The new NTX MindStorms system
6. The FIRST LEGO League (fall)
7. Imbedding robotics into the classroom
8. Encouraging individual creativity and fostering teamwork
9. On-line resources and books that are available

## **The new NXT MindStorms product**

This basic workshop is designed to cover getting a team or a class going using the LEGO MindStorms kit. The newer NXT robot kits have now been available for almost 2-1/2 years so we will focus primarily on these, but will try our best to cover both as requested.

The kit comes with motors and sensors that have a more “Technic” or “Bionicle” look. The connections are made with a phone-jack type plug. The NTX (the brain) has more memory and can communicate with the computer using either a USB cable or by using BlueTooth technology. The motors have built in rotational sensors for control and the NTX can handle 4 sensor inputs (not counting the motors). There are new sound and distance sensors as well as improved touch and light sensors.

So all-in-all it is going to be an improvement, but also will require some new thinking on our part. Most of the parts that come with the kit are not your standard ‘knob and hole’ LEGO pieces, and our



experience has shown that there are definite plusses and minuses when working with the new kit.

## **Learn how to Program the robots!**

For many adults programming is a 4 letter word, but the LEGO® Group did a good job at making the NXT easy to program. During the course of the workshop you will have the opportunity to learn basic programming with the software and the NXT brick.

For those still using the RCX we will work with you as well in understanding the basics with the RoboLab software. Since most computers that run one will not run the other we anticipate only having a couple of computers able to run the RCX RoboLab software.

The software environment is 100% graphic and allows you to build a flow chart styled program that logically progresses along in its function.



## **Building a Robot**

Since robotics is a two part process, you also need to build a robot. We have basic instructions for beginner robots using either the NXT or RCX robot kits.

During the course of the workshop increasingly difficult missions will be worked on and participants will have to modify their robots to complete the tasks.

### **The FIRST LEGO League (fall)**

The FIRST LEGO League (FLL) is an international program for ages 9 to 14 and runs from September to December.

Each year teams of 2 to 10 children work on building robots that can solve the year's missions while also researching and presenting a problem related to the year's theme.

This year's theme is **CLIMATE CONNECTIONS** and focuses on global climate issues. Missions include insulating a house, doing wildlife research, taking ice core samples, installing flood protection and many more.

There are 14 missions this year, the most ever! All played on the 4' x 8' playing field and teams have 2-1/2 minutes to complete as many as possible. Its all about teamwork, brainstorming, and reliability.

Each team also identifies a problem or condition that they want to research (having to do with climate) and then researched information about that topic, including brainstorming ways to improve the problem or condition for the future. Answers have to be original, thought out, but not necessarily up to engineering standards. Each team gives a short presentation to the judges at the tournament and answers questions raised.

Other areas that the teams are evaluated on include; programming, robot design, team spirit, team work, and innovative thinking.

### **Imbedding robotics into the classroom**

With more than a million MindStorms kits having been sold by the LEGO Group, it isn't surprising to see more and more teachers having access to them in the classroom. The kit can be used to build robots, demonstrate/experiment

with mechanical principles, and to collect data from the classroom environment.

Because robotics is a multi-disciplinary field it can be incorporated into a number of different programs within a school.

#### **Mathematics:**

By experimenting with robots and the resulting actions you can do work with  $F=ma$ , coefficients of friction, conservation of momentum, gear ratios, data collection and evaluation, and plain old general math. The units can also data collected in and export for use in Excel or other software programs.

#### **Science:**

Simply by building and working with robots you can teach general science, mechanics, physics, electrical engineering, system design, and computer programming. But on a larger scale you can look at how robotics impacts all of the other avenues of science. Want to study deep see ocean floors? Then have the children investigate how robots can make that less expensive, safer, and more complete.

#### **Language Arts:**

Having to work as a team to do the research, develop a report and presentation, and then give that is a perfect example of how Language Arts can be tied in to the FLL program.

The real limit on how this system can be used has to do with your imagination, not the equipment. Once you and the children are familiar with the capabilities of the system do some brainstorming on what you would like to study in your school.

#### **Encouraging individual creativity and fostering teamwork**

Perhaps one of the greatest impacts that can be accomplished with a robotics program is the involvement of the individual and the creation of positive teamwork. There are few times in a

modern classroom where a child can be asked to create a technological marvel, be given minimal guidance, told to do it their way, and still have a great success.

At numerous camps, expos, and workshops, children and adults have come in with no prior experience at building robots or programming and within as little as 2 hours have built and programmed a robot for the first time. The question "what does it do?" is answered with "what do you want it to do?" and that changes the world from one of watching to one of doing.

Everyone is capable of great things. Some guidance, the right parts, and imagination and it comes out, usually there isn't any way to stop it.

#### **Links for more information:**

Good source for purchasing the kits

[www.legoeducation.com](http://www.legoeducation.com)

Home page for the new NXT kit

[www.mindstorms.com](http://www.mindstorms.com)

Maine Robotics home page

[www.mainerobotics.org](http://www.mainerobotics.org)

FIRST's home page

[www.usfirst.org](http://www.usfirst.org)

International Home Page for the FLL

[www.firstlegoleague.org](http://www.firstlegoleague.org)

#### **Robotic Curriculum Pages:**

RoboLab Curriculum at Tufts Center for Education Engineering Outreach

[www.ceeo.tufts.edu/robotlabatceeo/k12/](http://www.ceeo.tufts.edu/robotlabatceeo/k12/)

Botball Curriculum from KIPR (KISS Institute of Practical Robotics)

[www.kipr.org/curriculum/curriculum\\_intro.html](http://www.kipr.org/curriculum/curriculum_intro.html)

NASA Robot Educational Matrix

<http://robotics.nasa.gov>

Carnegie Mellon University. Robotics Academy  
[http://www.rec.ri.cmu.edu/education/robotic\\_scurriculum/index.html](http://www.rec.ri.cmu.edu/education/robotic_scurriculum/index.html)

# Registration:

Mail this form or email the equivalent information to:

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Name: \_\_\_\_\_

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Email: \_\_\_\_\_

School/group: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_

State: \_\_\_\_\_ Zip: \_\_\_\_\_

September 23<sup>rd</sup> – Auburn

September 26<sup>th</sup> – Portland

Other \_\_\_\_\_

Check website for others as they develop.