MN High School Robotics 2006
MISSIONS

ATOMIC FORCE MICROSCOPY Mission: Free the probe's nanotip. The robot must separate the nanotip from the material surface. The nanotip separated from the surface is worth **40** points.

SELF-ASSEMBLY Mission: Start the self-alignment of atoms. The robot must cause the angled blue nanotube segments to align horizontally end to end. This alignment is worth **25** points.

SPACE ELEVATOR Mission: Operate the space elevator. At least one robot must cause the car with the yellow cargo to come down. If this mission is completed, no matter which robot or robots worked on it, both teams get **40** points.

NANOTUBE STRENGTH Mission: Lift the truck by a thin cable of carbon nanotubes. The robot must move the truck onto the lift frame and activate the lift. The truck completely on the frame is worth **20** points. The truck and frame supported completely and only by the cable is worth an additional **20** points.

INDIVIDUAL ATOM MANIPULATION Mission: Move individual atoms accurately. Counting atoms left on the surface, each white atom removed is worth **12** points, one red atom removed is **-10** points, two red atoms removed is **-20** points and more than 3 red atoms removed results in **0** points for the entire mission.

MOLECULAR MOTOR Mission: Retrieve and Deliver two adenosine triphosphate (ATP) molecules to power a molecular motor, causing it to spin and release energy. The robot must retrieve ATP molecules from one of six random locations defined below. Each molecule returned to Base is worth **25** points. The robot must then deliver ATP molecules through the molecular motor's black frame (even if nothing else happens). Each molecule through the frame is worth **20** points.

STAIN-RESISTANT FABRIC Mission: Test some stain-resistant fabric. The robot must deliver the dirt trap to its location mark and completely dump out the tester's dirt dumper. The dirt trap at its mark is worth **15** points, and the dirt dumper when empty is worth **15** points. The dirt pieces are Bonus Objects, worth **7** points each in the dirt trap, and **3** points each everywhere else on the table. If the dirt trap is then retrieved back to Base, every dirt piece in the trap is worth an additional **5** points each. When removing dirt for a Bonus Loss, the referee takes stray pieces first, then pieces from the dumper, and pieces from the trap last. Dirt pieces in the dirt trap returned to Base are "safe" and no longer eligible for removal.

SMART MEDICINE Mission: Retrieve and Deliver medicine to reach only a specific problem spot. The Buckyball must be retrieved from it's random location within the Buckyball drawing on the mat (see below). Returning the Buckyball to Base is worth **40** points. The robot must then release the Buckyball containing medicine into the person's arm. The Buckyball placed anywhere in the red/yellow channel of the bone is worth **50** points (even if it hasn't reached the problem spot).

SMELL Mission: Transfer molecules from the pizza toward the nose. The robot must get pizza molecules completely off the paper plate for **5** points each, and transferred to the yellow or black areas of the person's head or neck for an additional **10** points each.

"SAME DAY MISSION": There will be a mission announced the morning of the tournament. There will be working time in the morning for all teams to work on this mission.

Bonus Points

Head to Head placements.

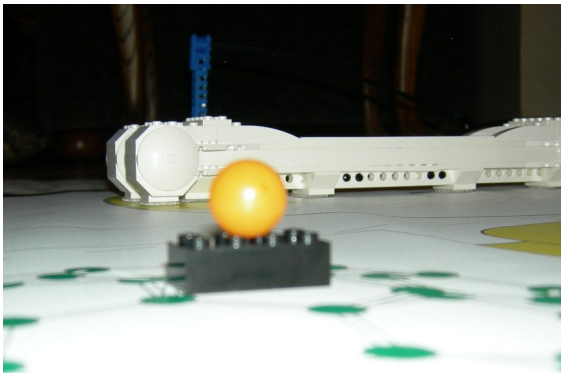
- **1st Place**. 50 points added to best score in Head to Head.
- **2nd Place.** 30 points added to best score in Head to Head.
- **3rd place.** 20 points added to best score in Head to Head.
- **4th place.** 10 points added to best score in Head to Head.

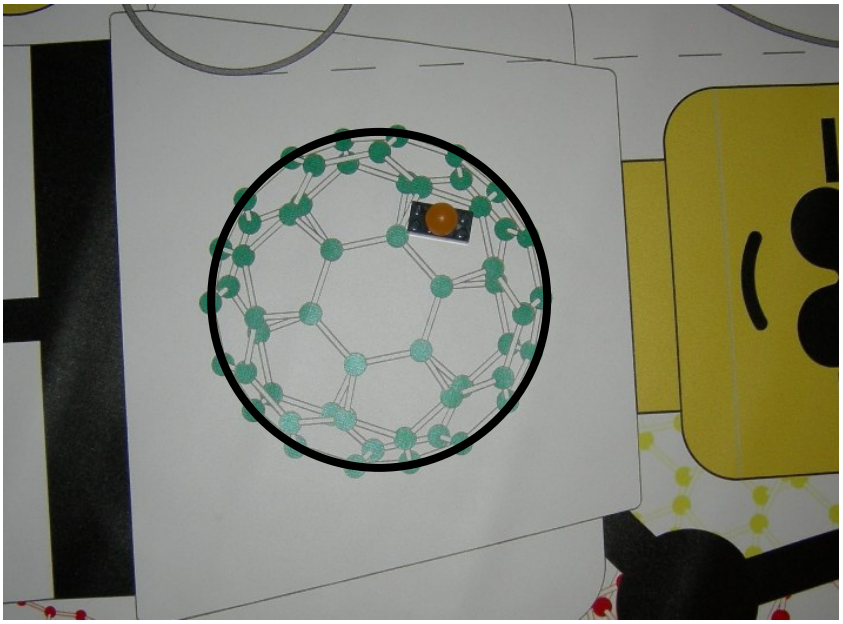
Additional Rules

Two Robot Division. In the Two robot division, either robot may do any of the missions. It's is the team's choice how to split the work. It was felt that moving to the NXT and adding additional sensors provides enough new challenges without adding communicating robots. Each robot in the Two Robot division must follow all the same rules (below) as the one robot in the One robot division.

Buckyball Placement

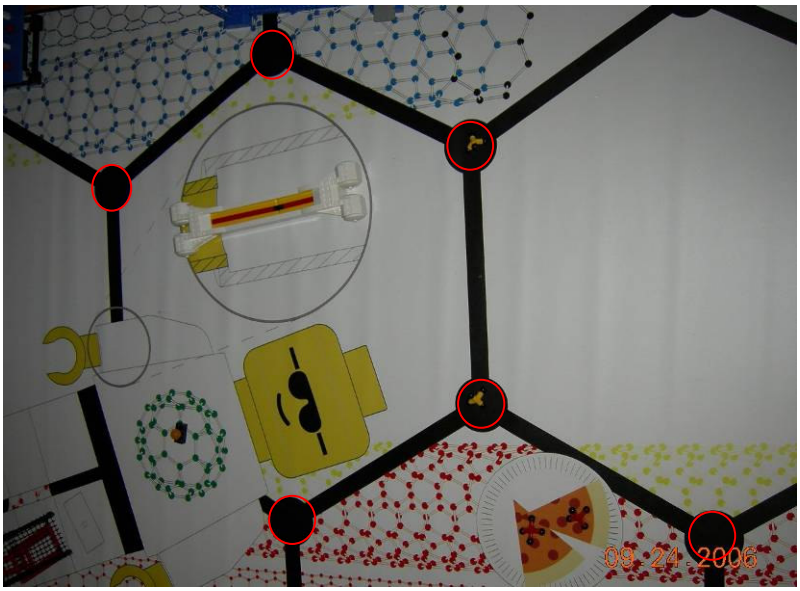
The Buckyball will be placed on the center of a black 2x4 standard Lego brick, which will then be placed randomly completely within the green buckyball drawing on the Lego figure's chest. It will not have any particular orientation.

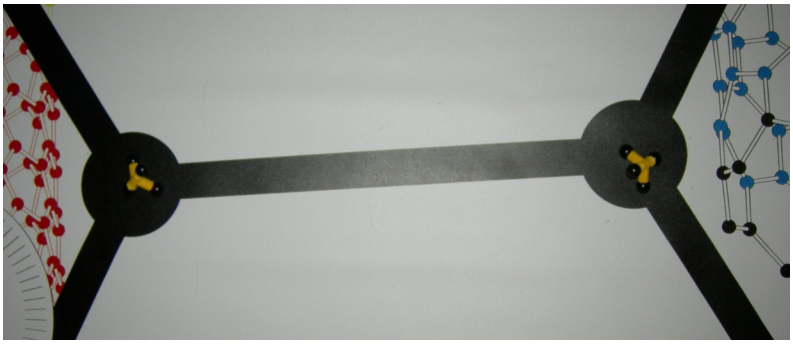




ATP Molecules Placement

The two ATP molecules will be placed randomly completely within one of the 6 black nodes, as shown in red circles below. The molecules will be in different nodes and in no particular orientation.





Rules

Please see the FLL Robot Rules (at www.firstlegoleague.org). All rules apply here with the following exceptions:

7 ROBOT The robot is defined as the RCX OR NXT brick(s) and anything currently connected or attached to it. Mission models, strategic objects, separate pieces, and separate mechanisms are not part of the robot. The robot may have two bricks (see rule 8).

8 MATERIALS
With two exceptions, noted in paragraph 8.5, EVERYTHING the team brings with it to the COMPETITION AREA of a tournament must be made entirely of LEGO elements in original factory condition. Electrical parts are limited in type and quantity to 2 “bricks” (any combination of RCX and NXT), Wires are not limited. Stickers, paint, tape, glue, oil, etc. are not allowed, except marker can be used for owner identification in hidden areas only. This rule applies only to the competition area (except remote controls are not allowed anywhere).

In the Two Robot division, the team may have two independent robots, defined as above. Each Robot may have 2 “bricks” (any combination of RCX and NXT).

~~At the competition table, the robot, its attachments, and all strategic objects must be made entirely of LEGO elements in original factory condition (except LEGO string and tubing may be cut to length). At the competition table, the total package of robot, attachments, and~~

strategic objects when viewed all at once must conform to the following quantity limits on electrical parts, no matter what the team intends to use at any one time:

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)
3rd touch OR light sensor (1)	ultrasonic sensor (1)

LEGO wires and converter cables are allowed as needed. Spare/alternate electrical parts are allowed in the pit area. Objects functioning as remote controls are not allowed anywhere. There are no restrictions on the quantity or source of non-electric LEGO pieces. Stickers, paint, tape, glue, oil, etc. are not allowed, except marker may be used for owner identification in hidden areas only. To participate in a match, a team must follow this rule.

8.5 Two Additional Allowed Sensors. In addition to the sensors sold by LEGO, two additional sensors from HiTechnic (http://www.hitechnic.com/) are allowed:

- Infrared Proximity Sensor (Model IR1021)
- Magnetic Compass Sensor (Model MC1032). When the NXT Compass sensor is released in October, 06, that will also be allowed.

A team may only have 1 of each on the robot. In the two robot division, you are still limited to 1 of each overall for both robots (you can't have a proximity sensor on each robot for example).

9 SOFTWARE The robot must be programmed using LEGO MindStorms or RoboLab software (any version). There are no restrictions on which software used to program the robot..

11 BASE Base is an imaginary hollow shape formed by vertical walls that rise from the perimeter of the Base's footprint (including the inside surfaces of the border walls), and by an invisible ceiling 16 in (40 cm) high. NOTE: Base is a VOLUME—not an area.

In the Two Robot Division, both robots use the Base and all rules apply to each Robot.

36 CHALLENGE QUESTIONS/SUPPORT For official answers to questions about the HSR challenge, contact Fred Rose @ fredrose@hightechkids.org (preferred) or at 612-386-7106. For official answers to questions about the Robot Game part of the Challenge, including rulings on special strategies or situations, e-mail flltech@usfirst.org (most efficient) or call 1-800-871-8326, x118 (less efficient). For best results, be sure you've read the four documents listed above, under the rule READ THIS FIRST. When e-mailing, be sure to put "Challenge" in the subject line, and please state your role on the team (member, coach, parent, mentor). When calling, please leave your contact information slowly, your role on the team, and YOUR QUESTION on voicemail. NOTE: flltech can not support LEGO product, and does not answer questions about building or programming the robot. NOTE: The FLL International Forum is great for sharing ideas, but it is NOT A RELIABLE SOURCE OF ANSWERS about the Challenge.

Research Challenge

See the Adventium Research Challenge Document.

Awards

The remaining awards and weightings are listed below. Please note this is subject to change and input on this is welcomed. These awards would be by division, except as noted. In other words, these awards would be given to teams in One Robot Division and Two Robot Division.

As done last few years with the Director's Award winner in High School FLL, a scholarship will be given to the winning team. That means winning team in One Robot division and Two Robot division. These amounts will be announced shortly. Trophies will be given to top 3 teams overall.

Award	What is it?	Why?	Percentage of total (master score
Judges (1 overall)	Whatever judges want	Because there always seems to be a need for this. Only a trophy.	0
Team Management	Teamwork, team/project management. 50% of this award is based on observation of team solving the same day mission, 50% on how the team managed themselves during the season (per questions).	Expand teamwork to include project mgmt and also a view into how the team handled the same-day mission. No trophy, only counts towards score.	10
Research Challenge (probably only 1 overall)	Presentation of research.	Doing research and presenting it is important.	25
Robot Seeding	Best score from seeding rounds (2 rounds)	No trophy for this.	10
Robot Challenge	Result from head to head challenge. Best score plus bonus. (add a bonus for top 4 places – 1st 50, 2nd 30, 3rd 20, 4th 10; this would be added to your best score).	Head to Head now counts for something. Getting the robot to perform is one of the prime objectives of the competition.	55