

- Science Olympiad -

Review of 2007 ROBOT RAMBLE Rules

October 7-8, 2007 Michael Kobe, National Event Coordinator

DESCRIPTION: The object of this event is to design and build a robot capable of performing certain tasks on a prescribed playing field. Each team may enter only one robot that must be built prior to the competition.

A TEAM OF UP TO: 2 **APPROXIMATE TIME:** 5 minutes/Team **IMPOUND:** Yes

MATERIALS:

a) Each team may enter only one robot that must be built prior to the competition.

Even though the rules say one robot per team is allowed, two teams showed up at the 2005 National Tournament each with two robots on the playing field.

b) The robot may be constructed of any material (R/C vehicle, plastic, metal, Plexiglas, Lego's, wood, K-nex, Robotix, Erector set, Vex, etc.).

2002/2003/2004/2005 National Tournament Data

- *Erector – 3/4/3/3*
- *K'nex – 8/1/2/1*
- *Lego – 6/5/3/4*
- *Metal – 4/9/16/14*
- *Plexiglas – 2/5/1/6*
- *Robotix – 10/7/1/4*
- *R/C vehicle – 8/6/9/7*
- *Wood – 2/3/12/15*
- *Miscellaneous – 11/5/1/6*

Range of robot cost at the National Tournament for 2004 and 2005:

	2004	2005
<i>under \$100</i>	<i>51%</i>	<i>34%</i>
<i>\$100-\$500</i>	<i>40%</i>	<i>59%</i>
<i>\$500</i>	<i>13%</i>	<i>7%</i>

- *Average Robot cost for 2005 was \$124.12*
- *Average cost of top ten robots in 2004 was \$232.90*
- *Average cost of top ten robots in 2005 was \$138.75*

Finish position of the most expensive robots at the National Tournament:

<i>Year</i>	<i>Amount Spent</i>	<i>Place</i>
<i>2002</i>	<i>\$1,000</i>	<i>7th</i>
<i>2003</i>	<i>\$3,000</i>	<i>21st</i>
<i>2004</i>	<i>\$1,200</i>	<i>21st</i>
<i>2005</i>	<i>\$1,000</i>	<i>25th</i>

Robot cost for the top ten teams at the national tournaments:

	2002	2003	2004	2005
1	\$70	\$35	\$500	???
2	0	???	\$75	\$150
3	???	\$1,000	\$150	???
4	???	???	\$500	\$175
5	\$150	\$500	\$50	\$300
6	\$3	\$500	\$30	\$50
7	\$1,000	\$150	\$500	\$50
8	\$2	\$150	???	\$250
9	\$20	\$30	\$100	\$100
10	\$300	\$200	\$100	\$35

c) The robot may be controlled remotely (Radio control, infrared, etc.) and/or with a battery powered (9.6 volts or less) control box that has wires leading to the robot.

2002, 2003, 2004, 2005, and 2006 National Tournament Data

- *Radio controlled – 22/18/15/28/30*
- *Combined – 6/6/5/2/6*
- *Tethered – 28/25/29/27/22*
- *Infra red – 0/3/0/1/2*

2002, 2003, 2004, 2005, and 2006 National Tournament Top Ten:

- *Combined – 2/1/3/1/0*
- *Tethered – 5/5/5/5/3*
- *Radio Controlled – 3/4/2/4/6*

d) At the start of the competition, there is a size restriction for the robot. The robot must be able to fit into a Plexiglas qualifying cube with inside dimensions of 30 cm x 30 cm x 30 cm, with the exception of the wires that connect to the student control box(es).

- *Two did not qualify at the 2002 National Tournament.*
- *All Qualified in the 2003 National Tournament*
- *All Qualified in the 2004 National Tournament (one almost didn't)*
- *All Qualified in the 2005 National Tournament*
- *Two teams did not qualify at the 2006 National Tournament.*

e) The robot circuits must be energized by one or more commercial batteries with a voltage not to exceed 9.6 volts. The voltage stated on commercial batteries will be accepted.

- *Two or possibly three did not qualify at the 2002 National Tournament.*
- *At the 2003 National Tournament one team was disqualified for too much voltage*
- *At the 2004 National Tournament all teams qualified for voltage.*
- *At the 2005 National Tournament all teams qualified for voltage.*
- *Voltage used in 2005 at the National Tournament: 18 at 9.6V, 7 at 9.0V, 6 at 7.2V, 15 at 6V*

- f) If multiple batteries are used, they may be connected in series or parallel as long as the voltage output does not exceed 9.6 volts.**
- *Batteries with a 9.6 voltage may be connected in parallel and the resulting output will be 9.6 volts.*
 - *In 2002, one robot competed at the regional, then the state tournament then had batteries in series which resulted in 24 volts. It was disqualified at the National Tournament in 2002 but had competed in both regional and state competitions at 24 volts.*
- g) Each robot function (such as drive train, arm, etc.) may have its own independent circuit, source of electrical energy, and control mechanism.**
- *Most robots at the National Tournaments had separate circuits for each function (multiple channel control systems). Several had multiple tethered controls.*
- h) Hydraulics, pneumatics, and fluidics will not be allowed. Only electric circuits may be used in the activation of the robot.**
- *Potentially a dangerous mechanism*
 - *One robot with a pressurized system was at the 2002 National Tournament.*
 - *No compliance problems in 2003, 2004, 2005, or 2006.*
- i) If the robot is “radio-controlled” (R/C), systems may be controlled by more than one transmitter. Each transmitter must be energized by one or more commercial batteries with a total voltage not to exceed 9.6 volts per transmitter**
- *Transmitter voltage has little effect on performance in this event*
- j) The robot must have a legible team name on it.**
- *Eight teams did not meet this requirement at the National Tournament in 2005.*
 - *All teams were in compliance in 2006*
- k) Radio control equipment used for this event must operate on frequencies designated by the Federal Communications Commission (FCC) regulations for surface devices (cars, boats, etc.). The frequency must be marked by the manufacturer on the transmitter. Allowable frequencies are:**
- 75 Mhz band (75.41 through 75.99 Mhz), which contains 30 channels
 - 27 Mhz band (26.995 through 27.255 Mhz) may be used but is not encouraged for the competition.
 - 49 Mhz band (49.8302 through 49-890) may also be used but is not encouraged for the competition. This band is generally used by the toy industry for Radio Controlled (R/C) toys.
- NOTE:** 72.0 Mhz band through 73.0 Mhz band is restricted by the FCC for R/C model aircraft and cannot be used for the competition. Teams using this band may not compete in the event. It is illegal to use this Band for surface craft and the user is subject to a penalty by the FCC.
- *References: FCC Regulations, <http://wireless.fcc.gov/prs/radcntl.html>*
 - *The frequency must be on the transmitter – a FCC regulation. In 2004 and 2005, one team in each year had no frequency label. In 2006 all teams were in compliance*
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PLAYING FIELD See <http://www.soinc.org/events/robotram/> for a diagram of the Playing Field

a) The playing field for the event shall be constructed on a piece of smooth, dense, short nap carpet approximately 4 feet by 8 feet. Students may not step or stand on the playing field.

- *The carpet that I've been using and will continue to use for the tournaments is indoor/outdoor carpet with no nap to it. It's almost like a thick felt. This carpet is obtainable from Menards hardware stores.*

b) The playing field will be marked on the carpet with a permanent ink-marking pen. Each line on the playing field will be approximately 1/2 inch wide.

- *The same playing field has been use for all six years of this event with no changes.*

c) The playing field will be a rectangle one meter wide by two meters long, divided by a centerline into two one meter square zones. One zone will be Zone A and the other zone will be Zone B.

- *The same playing field has been use for all six years of this event with no changes.*

d) Zone B will be the starting position for the robot.

- *A good way to remember this is that the "B" is for Bot.*

e) Zone A will contain all of the scorable items at the start of the competition. An equilateral triangle, 30 cm on each side, will drawn on the playing field in the approximate center of Zone A. The side of the triangle nearest the centerline will be parallel to the centerline of the playing field.

- *In 2007, a CD will be placed in the center of the triangle, flat, on the carpet label side up; additionally a stack of ten penny coins will be placed on top of the alignment hole on the CD.*

f) All materials for the event, including the playing field, qualifying box, compact disk (CD), goal box, Ping-pong balls, balloons, corks, etc. will be provided by the event supervisor.

- *Students will inflate the 9 inch balloons.*
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COMPETITION:

a) All robots and control systems must be impounded before the start of the competition and will be released after the last team has finished competing. Robots and controls entered by teams that have filed an appeal may be retained by the event supervisor until the appeal process is completed.

b) At the start of the competition, the event supervisor will place the following objects in Zone A: 2 Ping-Pong balls (approx. diameter 38 mm), 1 compact disk (CD), 9 laboratory cork stoppers (three size No. 4, three size No. 7, and three size No. 12), and 10 United States copper clad penny coins.

c) A tower of three laboratory cork stoppers, with the largest cork on he bottom and the smallest cork on the top (1 ea. Size No. 4, 7 & 12), will be placed on the three corners of the triangle in Zone A. Standard sizes for corks are:

- **size #4 top diameter 15mm, bottom diameter 12mm, length 20mm**
- **size #7 top diameter 20mm, bottom diameter 16mm, length 25mm**
- **size #12 top diameter 28mm, bottom diameter 23mm, length 31mm**

- d) A standard (12 cm diameter) Compact Disk (CD) will be placed flat, label side up, on the playing field in the center of the equilateral triangle. A stack of 10 pennies will be placed on top of the CD on the alignment hole.**
- e) Two Ping-pong balls will be placed on the line that divides Zone A from Zone B. One will be placed 3 inches from each end.**
- *Caution: There is a new official standard for the size of ping-pong balls*
- f) A goal “box” with inside dimensions of 30 cm x 30 cm x 30 cm, with no bottom or top will be placed inside of the playing field with an open side up in the middle of the center of the line that divides Zone B and Zone A in a diagonal configuration so that the two opposite corners are both on the center line. The goal box must be made of Plexiglas.**
- *Plexiglas goal box is preferred over wood*
 - *The goal box may also be used to qualify the robot prior to the competition.*
- g) The team will inflate and tie off three circular 9" blue balloons (to the same or all different sizes, at their discretion) and place them in the goal box. They will also place one red 9" balloon (inflated or deflated) in the box. The 9" refers to the manufacturer's recommended maximum inflated diameter of the balloon. All four balloons must fit completely within the goal box.**
- *Most made the balloon very taut and forced it into the goal box. Many did not understand the logic of filling the balloon to near capacity. One team's strategy was to only inflate the balloon to the size of a tennis ball.*
- h) At the start of the competition, students will place their robot in the designated starting position inside of the playing field at the center of the end boundary line of Zone B.**
- i) Once the robot is in place, teams will place a qualifying cube over the robot. If the robot does not fit in the cube, the students will be allowed to compete but their robot will be ranked behind all of the other robots that do qualify. After this point, students may not touch their robot.**
- j) The students will then remove the cube. After the qualifying cube is removed, the robot may self-activate a change in size or shape (not start). These changes may not be activated mechanically or electronically by the students until the two-minute competition begins. The competition will start by having the judge acknowledge that the students are ready, then count aloud 1, 2, 3, go. When the judge says “go”, the judge will start the stopwatch to begin the 2-minute competition.**
- k) During the two-minute competition, the robot should remove the scoreable items from Zone A (individually or collectively) and place them in the goal box.**
- l) Miscellaneous robot parts, or the entire robot, may end up in the goal box without penalty.**
- m) The robot should deflate the three blue balloons in the goal box. To earn points, the goal box and robot must be in bounds when the balloons are deflated. The robot should remove the entire red balloon (inflated or deflated) from the goal box.**

n) The robot may move the goal box but it must remain inside of the playing field., If it is moved out of bounds, the competition will stop and the score determined at that point (since the goal box is out of bounds the contents will receive no points).

o) The goal box must remain in the upright position. Tipping the goal box is OK as long as it does not go on its side. If it is turned on its side, the competition ceases at that point and the score will be determined prior to the violation.

- *Many teams throughout the nation designed robots in 2004 to tip the Goal box on its side; this was an impractical strategy. One robot at the 2004 National Tournament tried this and failed.*

p) If a scorable item (ping-pong ball, CD, pennies, or corks) is moved by the control wires, it will become out of play and may not be used to attain any points.

- *At the 2006 national tournament eight teams were penalized for this infraction.*

q) The competition will cease, if a student touches the robot or uses the wires or control box to physically move the robot. The score will be determined at the point where the violation occurred.

- *One team in 2004 and two teams both in 2005 and 2006 were stopped because they moved the robot with the control wires.*

r) The students will receive a warning if they step on the playing field. If they step on the field again, after receiving a warning, the competition will be stopped at that point and they will be scored based on the locations of the scoreable objects at the time the second violation occurred.

s) At the end of two minutes, points will be awarded based on the number and types of items that were moved from Zone A. If any part of the goal box is out of bounds, the scoreable items within will have no point value.

t) At the end of the competition, the event supervisor will allow 10 seconds for the robot to "come to rest" with the power off to determine if any parts are touching the ground outside of the playing field.

- *At the 2004 National Tournament, 5 robots were out of bounds at the end of the competition.*
- *At the 2005 National Tournament, 4 robots were out of bounds at the end of the competition.*
- *At the 2006 National Tournament, 3 robots were out of bounds at the end of the competition.*

SCORING:

a) Any scorable item that breaks the plane of the outer boundaries of the playing field, even if it is under the control of the robot, it is out of play and may not be used to attain any points.

b) A team will receive the following points for each item placed in the goal box:

- 2 Ping-pong balls = 10 points, maximum 20 points
 - 10 Pennies = 5 points, maximum 50 points
 - 1 Compact Disk (CD) = 25 points, maximum 25 points
 - 9 Corks = 5 points, maximum 45 points
- *At the 2006 National Tournament 24 teams committed this infraction.*

At the 2005 National Tournament, the following scoreable items were placed in the goal box:

- *Ping-pong Balls:*
 - None 12 (20%)*
 - One 3 (5%)*
 - Two 4 (7%)*
 - Three 6 (10%)*
 - Four 24 (42%)*
- *Golf Balls:*
 - None 32 (53%)*
 - One 28 (47%)*
- *Film Canister:*
 - None 30 (50%)*
 - One 30 (50%)*
- *Cork*
 - None 27 (45%)*
 - One 0 (0%)*
 - Two 4 (7%)*
 - Three 2 (3%)*
 - Four 2 (3%)*
 - Five 7 (12%)*
 - Six 17 (28%)*

At the National Tournaments, perfect scores were attained by:

- 17 Teams in 2002*
- 14 Teams in 2003*
- 11 Teams in 2004*
- 11 Teams in 2005*
- 10 Teams in 2006*

At the 2005 National Tournament, the following items were moved from Zone A to Zone B:

- 0 item10*
- 1 item3*
- 3 item2*
- 4 items.....4*
- 5 items..... 1n*
- 6 items.....7*
- 7 items.....1*
- 8 items.....3*
- 9 items.....3*
- 10 items.....3*
- 11 items.....7*
- 12 items.....15*

c) For every scoreable item removed from Zone A and placed in the goal box or in Zone B, the team will receive 1 point (maximum 22 points).

d) The team will receive 20 points for each of the blue balloons in the goal box that are deflated by the robot (60 possible points).

- *This is best achieved as the first task of the robot. If the balloon is deflated after the scoreable items are placed in the Goal box the explosion could force some of the scoreable items out of the Goal box.*
- *Twenty-one teams (35%) did not break the balloon at the 2005 National Tournament.*

e) If the robot removes the red balloon from the goal box, the team will receive 40 points. NOTE: If any parts of the red balloon remain in the goal box, the team will receive none of the 40 points.

f) If the robot (parts touching the ground) is completely in Zone A or the Goal Box at the end of the competition, the team will receive 15 points.

- *At the 2004 National Tournament 5 teams out of 54 competing teams finished the event with the robot out of bounds*
- *At the 2005 National Tournament, 4 robots were not in the playing field.*
- *At the 2006 National Tournament, 3 robots were not in the playing field.*

g) The goal box is considered part of the playing field and must be completely in bounds at the end of the competition for the scoreable items it contains to have any point value.

- *Once the Goal box is out of bounds, the robot may push it back in bounds (this happened twice in the 2003 National Tournament and once in the 2004 National Tournament).*
- *At the 2004 National Tournament, one team pushed the Goal box out of bounds but could not move it back in bounds.*
- *At the 2006 National Tournament, 3 teams pushed the goal box out of bounds and did not push it back in bounds.*

h) The team with the most points will be the winner. In the case of a tie, the team that completed the task in the shortest length of time will receive the more favorable score value. If teams still have identical scores, the tie will be broken by massing the robot (which includes robot and batteries). The robot and its batteries with the least mass will receive the more favorable score value (ranking).

- *Scoring Hierarchy:*
 - *Points*
 - *Time to complete task*
 - *Mass of robot*
- *At the National Tournament, I mass the robot system in ounces.*
- *At the 2004 National Tournament, 11 teams had perfect scores and ties had to be broken by time.*
- *At the 2003 National Tournament, 14 teams had perfect scores and ties had to be broken by time. Also the 16th and 17th place teams had identical scores, the same time and the tiebreaker was mass.*
- *At the 2005 National Tournament, 11 teams had perfect scores and ties had to be broken by time. Furthermore, 2 additional ties were broken by mass.*
- *At the 2006 National Tournament, 10 teams had perfect scores and ties had to be broken by time*

i) Robots that fail to meet any of the specifications under “Materials” will be allowed to compete but will be ranked behind those that do.

- *The exception is robots that don't meet frequency specification will not be allowed to compete under FCC rules*

- *At the 2004 National Tournament, 3 robots did not meet the specifications and were ranked after those that did.*
- *At the 2005 National Tournament, 4 robots did not meet the specifications and were ranked after those that did.*

j) Robots that violate the FCC regulations will not be allowed to compete and will receive participation point(s) only.

- *If the transmitter does not indicate the frequency (or the label has been removed, or has been tampered with) the robot will not be able to participate*
- *At the National Tournament in 2004 and 2005, two robots did not have frequency tags on the transmitter.*
- *At the National Tournament in 2006, all robots had frequency tags on the transmitter.*

k) Maximum score is 277:

- **All items removed from Zone A to Zone B or Goal Box = 22 points**
- **10 Pennies = 50 points**
- **2 Ping-Pong balls = 20 points**
- **1 Compact Disk (CD) = 25 points**
- **9 Corks = 45 points**
- **3 Blue Balloons Deflated = 60 points**
- **1 Red Balloon Removed entirely from Goal Box = 40 points**
- **Robot in the Goal Box or Zone A of the playing field at the end of the 2 minute event = 15 points**

Maximum Scores

Item	Quantity	Value	Points
Items removed from Zone A	22	1	22
Pennies	10	5	50
Ping-Pong balls	2	10	20
Compact Disk	1	25	25
Corks	9	5	45
Deflated Blue Balloons	3	20	60
Red Balloon removed from Goal Box	1	40	40
Robot in zone A		15	15
Total Points			277

Times to complete the task at the 2002, 2003, 2004, 2005, and 2006 National Tournaments:

	2002	2003	2004	2005	2006
1st	13.98 sec.	7.15 sec.	12.8 sec.	5.65 sec.	14.3 sec.
2nd	15.75 sec.	12.81 sec.	14.49 sec.	6.19 sec.	23.4 sec..
3rd	22.5 sec.	14.45 sec.	28.7 sec.	10.87 sec.	31.3 sec.
4th	22.5 sec.	17.3 sec.	32.3 sec.	22.15 sec.	41.72 sec..
5th	26.42 sec.	20.68 sec.	42.0 sec.	26.59 sec.	56.5 sec..

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