2017 E^3 Engineering and Technology Fair

Engineering, Exploration, and Experimentation

Thursday, April 27, 2017 Clark Gymnasium at RIT

9:00 am to 1:00 pm

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The E^3 Fair Committee is pleased to announce the 27th annual **E^3 Engineering and Technology Fair**. The first E^3 Fair was held in 1991 and, consistently through each year, it continues to be organized and funded by a joint effort between engineering societies and area industries. The Fair's mission is to increase exposure of engineering and technology related fields to middle school students (grades 6 – 8). Students learn the importance of team and process concepts while they are preparing engineering and technology projects which include communicating and making a plan for success. It also allows for creativity and independent thinking. In addition, students learn about careers in engineering from professional engineers at the Fair.

The E^3 Fair is from 9am to 1pm with student competitions starting at 9am. When students are not involved in their competition, we encourage them to visit the booths where local engineering societies, colleges and industries will engage students with demonstrations of technology. Students will be eligible for a prize if they visit a designated number of booths.

There are three competition options available to students:

Science / Engineering Project (Option 1): Prepare a project or experiment for display that is based on engineering or technology principles.

Simple Machine (Option 2): "A Tractor Pull Vehicle" - Design and construct a machine, using only parts from a Lego kit (model number specified by the E3 Committee) capable of pulling a basket of weights, with the aid of a pulley, to a distance of 50cm within a time period of 30 seconds.

Robotics (Option 3): 'Robo Hockey" Design and build a robot using parts from a LEGO kit (model number specified by the E3 Committee) that can push plastic soda bottle caps arranged in a playing field to a designated goal area in the shortest time possible.

The Guidelines for the competition are available on the E3Fair website.

Middle schools in Monroe County and surrounding counties participate in the E^3 Fair. If you have participated in past Fairs, we hope to see you again. If you have not previously participated, join in – you will not be disappointed. It is a rewarding and fun experience. Please do not hesitate to contact us with any questions or comments.

Sincerely,

Jon Kriegel, Co-Chair and RES Liaison
Steven Day, Co-Chair
Adelaide Svoboda, Schools Contact
Jayanti Venkataraman, Design Contest

SCIENCE / ENGINEERING PROJECT (OPTION ONE)

GENERAL DESCRIPTION

Projects submitted for Option One will consist of full-size or scale models of a physical structure or device, a detailed description of a process, device, or structure, or data obtained from a project involving experimentation. The presentation of the project at the Fair may include posters, photographs, written work as well as any actual device that may have been constructed. The project and any other supporting data or displays will be placed on the table space assigned to the entrant. This space is limited and the physical dimensions of each entry must not exceed three feet (3 FT) in height, width, or depth; nor may it exceed 30 pounds in weight.

For each grade level, the following topics are suggested to provide a thematic background to the Fair. These suggestions are not intended to limit the students. These are topical areas of wide interest technologically and serve as useful guidelines for the students. If a team of students cares to choose a topic not listed, they may do so at the discretion of the teacher/advisor. Check our web page for updates on Frequently Asked Questions (FAQ).

Suggested Topics

A. ENGINEERING THE ENVIRONMENT

- forms of energy and energy utilization
- preserving our environment; waste disposal and recycling, product packaging
- protecting our atmosphere; global warming, ozone
- how humans and technology impact the environment

B. ENGINEERING FOR EXPLORATION, TRANSPORTATION, COMMUNICATION

- land, sea, air, and space
- communication and communication systems
- robotics, telepresence
- computers and computer technology

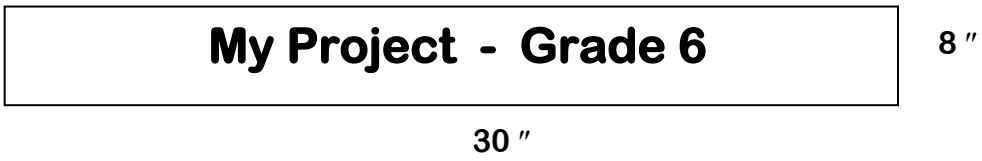
C. ENGINEERING FOR HEALTH AND BIOTECHNOLOGY

- genetic engineering
- artificial organs or limbs, medical devices
- food production, processing, storage
- new and novel ways of growing food

SCIENCE / ENGINEERING PROJECT (OPTION ONE) PARTICIPATION AND EVALUATION GUIDELINES

1. The Option One project and all associated presentation materials will be displayed on a table at the Fair. The total physical dimensions are limited to 3ft long x 3ft deep x 3ft high and a maximum weight of 30 lbs.

2. Each group should bring a sign (approximately 30″ x 8″) displaying the title and grade level An example for Grade 6 is shown below. This will be taped to the table on which the project is displayed.



3. Students participating in Option One must work under the guidance of a teacher or advisor.

4. Students currently in the 6th, 7th, or 8th grades are eligible to submit a project to the E^3 Fair. Those participating may consult any resource at their disposal during the design period, however all hands-on work must be done by the group members.

5. Option One projects may not contain any projectiles or flammable fuels of any sort. This includes but is not limited to gasoline, kerosene, and any acids or bases. The use of electricity is permitted and 120V power will be provided if requested on the Option One Registration Form.

6. Projects that have been part of a classroom activity or another competition or Fair, may be entered by the group that designed and built them.

7. Members of a team must belong to the same grade level.

8. The maximum number to a team is four students.

9. There is no limit to the number of eligible student groups that may participate in Option One of the E^3 Fair from any one school.

10. A Judging Committee will determine the winners in each grade level.

SIMPLE MACHINE (OPTION TWO)
AY2016-2017 Project: A Tractor Pull Vehicle

GENERAL DESCRIPTION:

Option Two involves an open-ended, hands-on, problem solving activity. Participants will solve the problem, build their solution, bring their solution of the problem to the Fair and participate in a competition

PROBLEM STATEMENT:

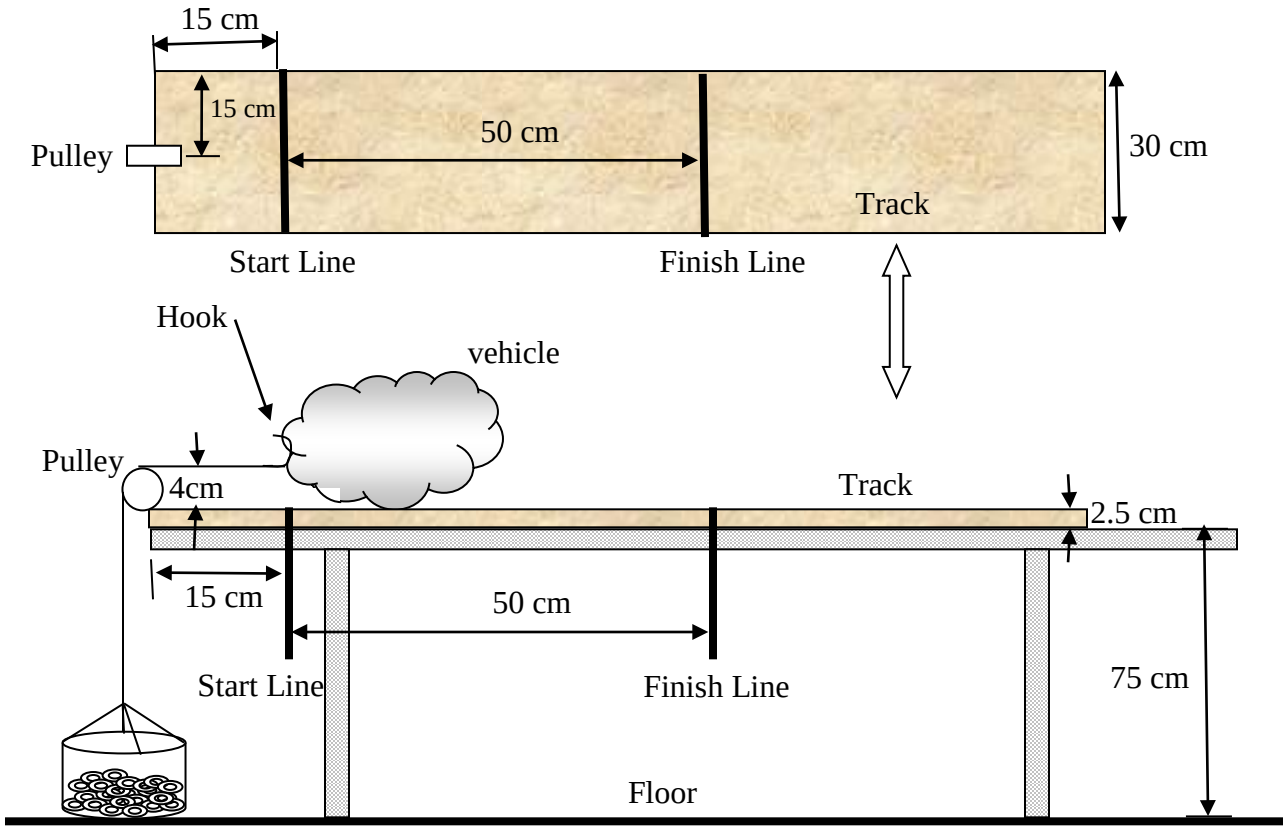
Design and construct a machine, using only parts from one Lego kit (model number specified by the E3 Committee), capable of pulling a basket of weight, with the aid of a pulley, a given distance in a given time. The machine will be placed on a platform provided by the Fair and must support itself without falling over while connected to the basket. The basket and pulley will be provided. The machine must pull itself and the basket to a distance of 50cm within a time period of 30 seconds, with an amount of weight selected by the competing team.

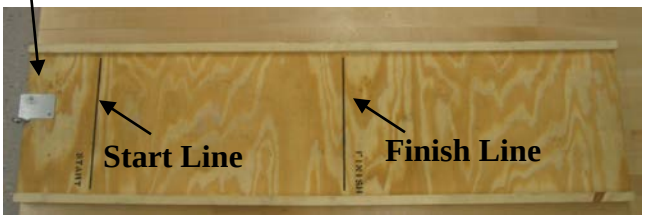
TOURNAMENT GUIDELINES:

1. Only parts contained within one LEGO Simple and Motorized Mechanisms Base Set may be used for the project, that is, #779686 or #9686. Older kits needing the newer motor can upgraded by getting the Power Functions M-Motor #8883, the Battery Box #8881, and the Power Functions 20" Extension Wire #8871.

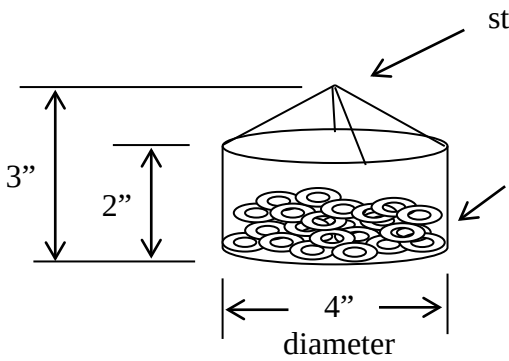
   Please contact the General Chair or the Design Contest Chair for questions regarding the admissibility of a kit, if not specified in the list above.

2. Neither the box the kit comes in, nor the instruction manual furnished with the kit, nor any parts from additional kits may be utilized to obtain a solution.
3. No part may be cut, sanded, whittled, polished or physically altered in any way. No oils, adhesives, tape, glues or chemical additives of any type may be introduced as part of the problem solution.
4. The vehicle must rest on the platform surface provided by the E3 committee, Figure 1, during the competition and must support itself while connected to the basket.
5. The battery pack must be attached to the vehicle and cannot be held by the team members.
6. The basket, which will be provided by the Committee, is a PVC cup 4 inches in diameter with strings converging to a singular point for attachment to the device. The basket will be rested on the floor as shown in the figure 1 shown below.
7. Flat washers, 3/8 inch in diameter, will be used for the ballast weight within the basket. Each washer weighs approximately 0.25 ounces. The tare weight of the basket, approximately 4.2 ounces, will be included in the total weight that will be recorded as the team's score. (Choosing pre-established weight combinations ensure an efficient use of time and standardization. This information is provided for participants to practice with any combination prior to the event.)





Weight Basket (rests on floor)



Flat washers placed within basket (as selected by team)

NOTE:
Dimensions shown are not to scale

Figure 1. Track Diagram for Tractor Pull

8. The vehicle must have an identified location for the attachment of the 'hook'. The Lego kit contains the hook that is attached to the weight basket via a string.

9. The hook is aligned to the Start Line as shown in the diagram. The distance between the Start Line and Stop Line is 50 cm. The vehicle must drag the hook over the Finish Line.

10. The front of the vehicle for direction of motion must be determined prior to the first lift and cannot be changed during the competition.

11. No modifications will be allowed to the vehicle during the entire competition.

12. The minimum starting weight will be the weight of the bucket (4.2 oz.) and 4 washers (each weighing approximately 0.25 oz.).

13. After the weight is added to the basket, the team will have 30 seconds, from the time the vehicle is switched on, to complete the pull / lift. During this time the vehicle has to travel a distance of 50 cm. (This means that the "hook" travels a distance of 50cm from the Start Line to the Finish Line)

14. Once the vehicle has been initiated, it must continue without human intervention.

15. After a successful lift, the team will continue to add as many washers as it wishes and perform the lift again. The team may continue to do so until the task cannot be completed as specified.

16. The weight of the last successful lift for which the vehicle travels the distance of 50 cm will be recorded by the judge as the team score.

17. All design decisions, journal entries, and assembly of the Lego parts shall be performed by the students on the team. They may consult any resource at their disposal for guidance or clarification, such as teachers and mentors while working through the problem solving process.

18. There is no limit to the number of eligible student groups that may participate in Option Two of the E^3 Fair from any one school. However, the number in each group, is limited to a maximum of four.

19. Decisions made by the Design Contest Committee Chair or by designated representatives are final.

Note: For questions / clarifications of the rules, please contact the Chair of the Design Contest Committee.

ROBOTICS (OPTION THREE)
AY2016-2017 Project: Robo Hockey

GENERAL DESCRIPTION

Option Three involves a robotic design, computer controlled, hands on problem solving activity. Participants will solve the problem, build their solution, bring their solution of the problem to the Fair and participate in a competition

PROBLEM STATEMENT

Design, construct and program a robot, using parts from a LEGO kit (model number specified by the E3 Committee),to move plastic soda bottle caps from a playing field into a specific goal area, in as short a time as possible. The playing field is a square of 36 inches, in which the caps will be arranged in a predetermined pattern. The robot will be placed in a 'Start Box'. The robot should fit in the Start Box and its size, shape and orientation should not change after it has been initiated. During the entire competition its size should be such that it fits in the Start Box. The robot should be able to get across and into the boundary circle. It can then push, lift or roll the bottle caps into the goal area for a period of 2 minutes, at which time it should turn itself off. The team score is the number of bottle caps collected in the goal area. The winner is the team that moves the largest number of bottle caps into the goal area in the shortest time.

TOURNAMENT GUIDELINE

1. Only parts contained within any **ONE** of the following LEGO Mindstorms kits maybe used. The software comes with a site license.
   - Mindstorms NXT kit # 979797 with software version 2.1
   - Mindstorms NXT kit # 5003402 with software version 2.1
   - Mindstorms NXT kit # 991308 with software version 2.1
   - Mindstorms NXT software #2000080 or #900080 (equivalent to version 2.1)
   - Mindstorms EV3 core kit #5003400, using software #2000045
   - Mindstorms EV3 core kit with software #5003462

   EV3 software is different from the NXT software, and may be a slight advantage to its users

   Participants may choose to use Robolab Team Challenge set #9797, accepting the fact that the motor in the NXT and EV3 kits are more powerful and robust.

   Lego Education no longer carries NXT products. You may still use the specified NXT kits/software for this year's E3 Fair.

2. No part may be cut, sanded, whittled, polished or physically altered in any way. No oils, adhesives, tape, glues or chemical additives of any type may be introduced as part of the problem solution.

3. The 'Playing Field' and the 'Start Box' are shown in figure 2.They are laid out on a white, masonite, hardboard, that is 1/8-inch thick, using good quality PVC black electrical tape of width ¾ inches where the inner dimensions of the Field is 36" by 36". It is best not to stretch the tape as it is being applied. Also, smooth out any wrinkles so that they do not

interfere with the robot's movement. The goal area is marked with walls along three edges made from 1x2 wooden furring strips that are 1¾" in height and ¾" in width. These can be screwed down to the masonite board, as shown.

4. The 'Playing Field", 'Start Box' and 'Goal Area' correspond to the inner edges of the tape.

5. The plastic soda bottle caps are arranged open side up, as shown, placed in a circle of diameter 18" with one in the center. There are a total of thirteen bottle caps. These caps are commonly found on soda pop/water bottles.

6. The robot will start from inside the 'Start Box' and should fit in this 'Start Box' as shown. Once it has been initiated, it should not change its shape, size or orientation during the entire competition. During the entire competition its size should be such that it fits in the Start Box.

7. The robot, initiated by the team members, should be able to get across the black tape boundary from the Start Box into the playing field. The robot can then push or roll bottle caps into the goal area.

8. Once the robot has been initiated, it must continue, without human intervention, until the run is complete.

9. The robot scores when a cap is completely over the boundary of the playing field (the outer edge of the black tape) and into the goal area.

10. The robot may use the area outside the playing field for turning only. It is not advisable for the robot to leave the masonite board since the edges of the board may be curled in which case it should be capable of climbing back on the playing field again. If it stays outside the playing field for more than 20 sec, the round will be considered over.

11. The time for the round is 2 minutes at which time the robot should turn itself off.

12. The team score is the number of bottle caps collected in the goal area over a period of 2 minutes. The winner is the team that moves the largest number of bottle caps into the goal area. In the event of a tie the winner would be the one with the shortest time. Each team will be allowed two rounds. The better of the two scores will be considered.

13. All design decisions, journal entries, and assembly of the robot must be performed by the students on the team. They may consult any resource for guidance or clarification, such as teachers and mentors, while working through the problem solving process.

14. There is no limit to the number of student groups that may participate in Option Three from any one school. However, the number in each group is limited to a maximum of four.

15. Decisions made by the Design Contest Committee Chair or by designated E3 Fair representatives are final.

Please contact the General Chair or the Design Contest Chair for questions regarding the admissibility of a kit or clarification of the rules.

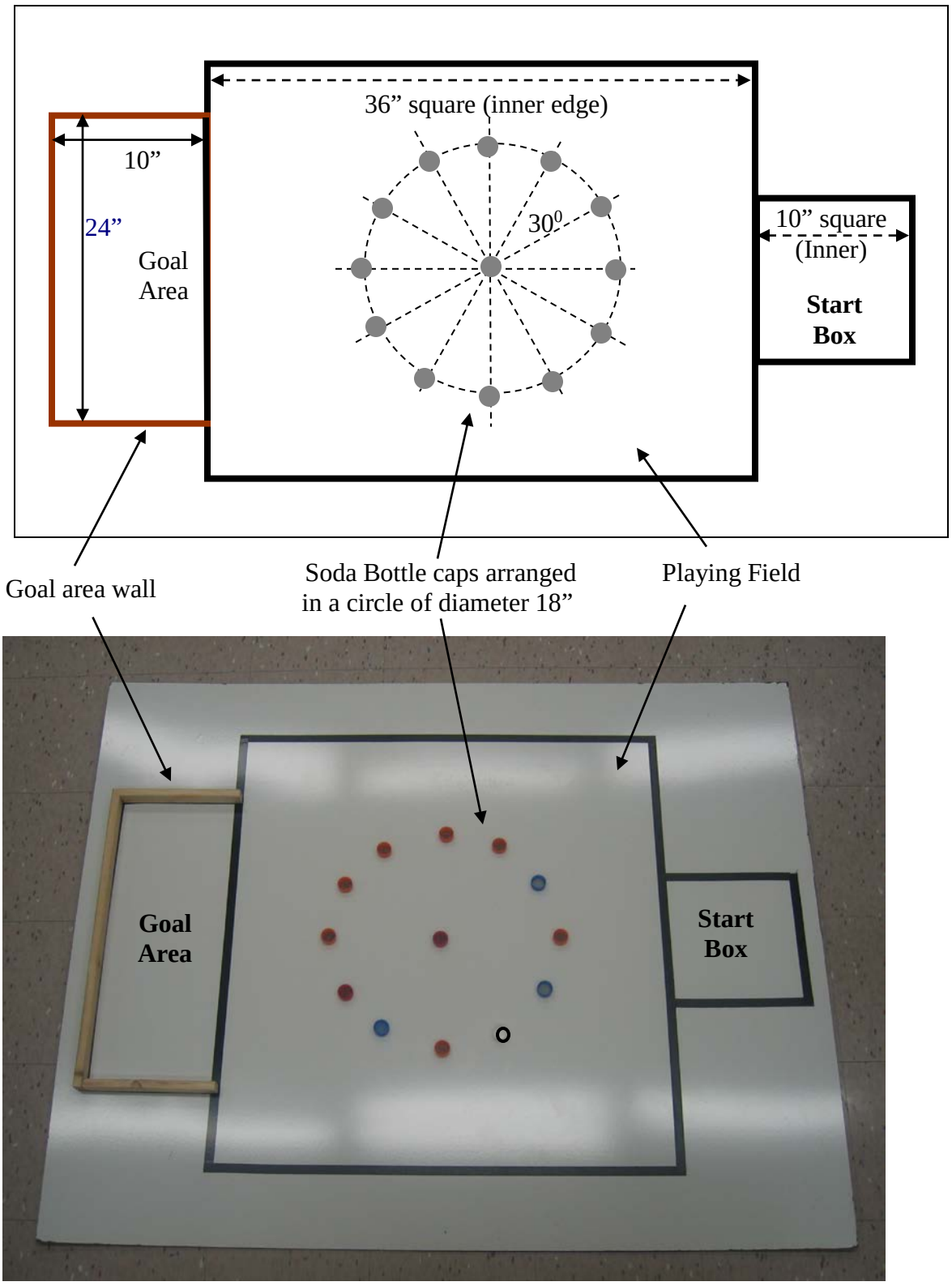


Figure 2 Robo Hockey Playing Field

PRIZES

Results will be announced at the end of the Fair. Trophies will be awarded to top performers.

Additional Activities at the E3 Fair

There will be a number of informational booths sponsored by various technical societies, local industries and area colleges and universities. These booths are intended to illustrate various aspects of engineering, science, and technology and inform both participants and visitors to the Fair of career opportunities in a wide variety of technical fields.

2017 E^3 FAIR - PROJECT REGISTRATION FORM
SCIENCE / ENGINEERING PROJECT (OPTION ONE)

www.e3fair.org

One copy of this registration form must be completed for each Option 1 project being entered in the E^3 Fair and submitted no later than **April 7, 2017.**

Please submit completed forms (online or mail or email) to:
Dr. Adelaide Svoboda, 70 Brandywine Lane, Rochester, NY 14618 asvobod9@naz.edu

Grade: _____

Name(s) of student(s)

1. _____

2. _____

3. _____

4. _____

School and address: _____

_____

_____

Sponsoring teacher/advisor: _____

Phone Number: _____

email : _____

Title of Project: _____
(60 characters max)

Anticipated special requirements:_____
(120-volt electrical power, compressed air, etc.)

2017 E^3 FAIR - PROJECT REGISTRATION FORM
SIMPLE MACHINE (OPTION TWO)
2014 Project - A Tractor Pull Vehicle

www.e3fair.org

One copy of this registration form must be completed for each Option Two project being entered in the E^3 Fair and submitted no later than **April 7, 2017.**

Please submit completed forms (online or mail or email) to:
Dr. Adelaide Svoboda, 70 Brandywine Lane, Rochester, NY 14618 asvobod9@naz.edu

Name **Grade**:

1. _____ _____

2. _____ _____

3. _____ _____

4. _____ _____

School and address: _____

_____

_____

Sponsoring teacher/advisor: _____

Phone Number: _____

email : _____

2017 E^3 FAIR - PROJECT REGISTRATION FORM
ROBOTICS (OPTION THREE)
2014 Project - Robo Hockey
www.e3fair.org

One copy of this registration form must be completed for each Option 3 project being entered in the E^3 Fair and submitted no later than **April 7, 2017.**

Please submit completed forms (online or mail or email) to:
Dr. Adelaide Svoboda, 70 Brandywine Lane, Rochester, NY 14618 asvobod9@naz.edu

Name **Grade**:

1. _____ _____

2. _____ _____

3. _____ _____

4. _____ _____

School and address: _____

_____

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Sponsoring teacher/advisor: _____

Phone Number: _____

email : _____