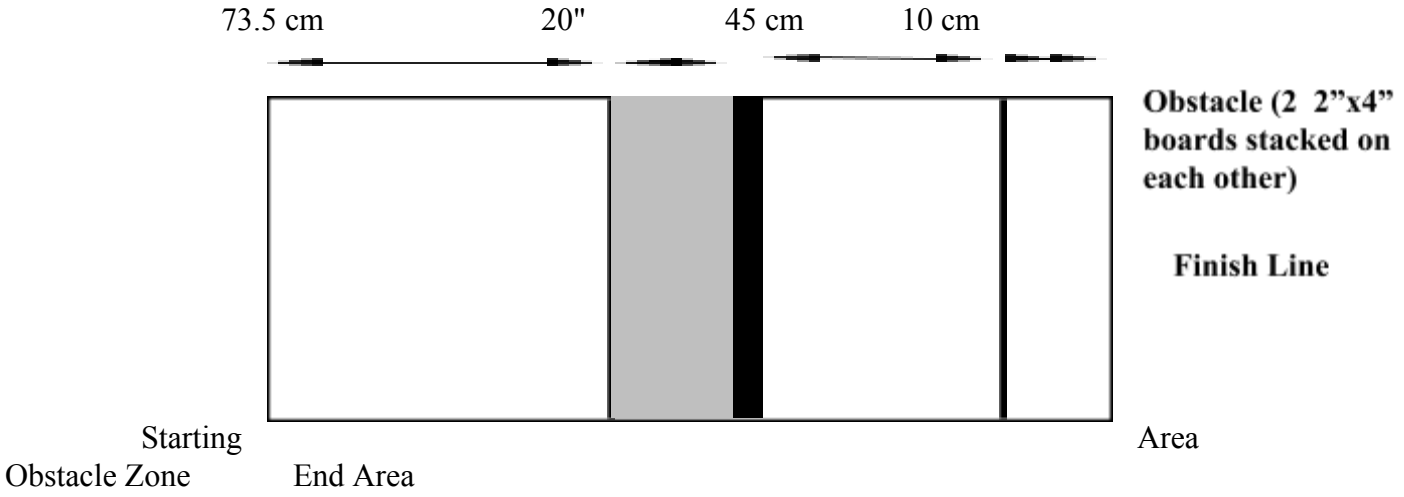
12th Annual LHS AP Physics Engineering Challenge
2014-2015

The Challenge:
The goal of this year's challenge is to design and construct a device that can be transported in its entirety over an obstacle, and stop at a marked finish line. Points will be awarded based on the precision with which the device completes the task. Standard lab tables (room 410) will be used for the challenge. The table sections will be designated as follows:



Scoring will be based on the whether the device clears the obstacle and proximity of the leading edge of the device to the finish line when the device stops moving. Bonus points will be rewarded for delivering a payload to the top of the obstacle. Before you begin work be sure to familiarize yourself with the detailed rules and scoring sheet that follow.

I. Teaming Rules: Students may work alone or with one partner. Partners may be in different sections of AP Physics 1 or AP Physics C and have different teachers.

II. Construction and Materials Rules: (See attachments for materials ordering information)

1. Your device may be powered by batteries and/or any number of mechanisms for the storing of potential energy (e.g., springs, weights, rubber bands, etc.) Batteries may not exceed the rated voltage for each motor (6 volts per motor).
2. Your device may use up to two electric motors. Only Gear Motor 7 or Right-Angle Gear Motor 6 are acceptable. No additional motors of any kind are permissible. Gears that fit these motors are also available.
3. The device must start with the flip of a knife switch. A knife switch MUST be used even if your device is non-electrical.

4. The knife switch may be used to complete an electrical circuit, release a latch, etc. It may NOT be used to provide mechanical energy to your device. (e.g. the switch may release a weight but may not push, pull, or lift a weight.)
5. The payload will be a Paper Mate® Pink Pearl® Elastomer Compound Eraser, LARGE. These are available at Staples.
6. The payload (eraser) will be provided. Your entire device must be impounded in a standard paper case box.
7. No liquids, explosives or combustibles, pre-compressed gases or animals (dead or alive) may be used. Closed containers of water ARE acceptable as masses.

III. Impounding Rules: (See scoring sheet for possible impounding penalties**)**

1. Your device must be impounded. It must be delivered to room 410 either between **7:15 and 7:35AM or 2:30 and 3:00 PM** on, March 9th. See score sheet for late impounding penalties.
2. Your device must be delivered in a stackable, lidded 45 cm x 30 cm x 23 cm standard copy-paper box (or similar, ± 8 cm in any dimension).
3. The box must be clearly labeled on two sides with team member and teacher names.
4. Nothing may protrude from the box. Other boxes may be stacked on top of yours.
5. Any tools or supplies (e.g. fresh batteries, duct tape, scissors, etc.) to be used for set-up and repairs on the day of the challenge must be impounded in your box.
6. Your insurance video must be impounded in the box. (See Scoring Sheet)
7. Any projects turned in after Monday March 9th will incur an additional 10 point deduction per day.

IV. Set-Up Rules:

1. The lab table will be labeled to indicate the starting area, the obstacle zone, and the finish line.
2. The obstacle will be provided and in place on the table but is not secured to the table.
3. Before each run, students will position their device somewhere in the starting area.
4. At the start the device may not extend above out of the starting area.
5. No part of your device may initially extend beyond the edges of the tabletop.
6. Your impounding box MAY be used as part of your device.
7. The device MUST be started with a single-handed opening or closing of a knife switch handle. The knife switch should be affixed in some way and may not be held with a second hand.
8. On the day of the challenge you will be given 5 minutes to assemble and run practice tests with your device before the official scoring runs.

V. Rules for Individual Runs:

1. If the device is completely unresponsive to the flip of the knife switch ***JUDGES*** may call a false start. Teams are allowed only ONE false start. A false start does NOT count as one of the two runs. Refer to the attached scoring sheet for the false start deduction.
2. Your device must work without aid. Once you have activated the device, you may not touch or actively control it until after scoring is complete.

3. At the conclusion of the run, ***NO*** part of the device may remain in the starting area on the starting side of the obstacle.
4. The obstacle may not be moved before or during your run.
5. During the run, points will be earned based on whether the device has completely cleared the obstacle, proximity of the leading edge of the device to the finish line upon stopping, and bonus points awarded for the correct placement of the payload.
6. Upon completion of your first run, you will be given up to 5 minutes to reset and retest your device before a second, final, scored run.
7. A maximum of two runs will be allowed (except in the case of a false start, which incurs a point penalty.) Only the higher score will be used for grading purposes.
8. At the end of the testing period, students must return the table to its original condition within 5 minutes.
9. Insurance videos will be collected at this time for any group scoring lower than 60 points.

VI. The Insurance Video:
If your device scores less than 60 points on the day of testing, you may use an insurance video (must be in the impounded box with your device). In order to obtain the insurance video score of 60 points, the video must very clearly show the device completing the challenge.

VII. Rules for Asking Questions:
Any questions that arise concerning the rules of this event must be submitted in writing to a First Class conference called "2015 Engineering Challenge". The physics teachers will discuss the questions and respond in writing. This can take up to a week, so ask early.

Words of Wisdom:
- START EARLY!
- Order the knife switch early, along with any motors or gears.
- Get your hands on the right size box. They get scarce when the impounding deadline nears. Storing your materials in the box will help you keep the size limitations in mind.
- Brainstorm before you build. Generate multiple design ideas before selecting a design strategy to pursue. Do plenty of thinking, planning, and sketching.
- Build your first prototype and test it repeatedly. Make some changes, and then test again... and again. If it can go wrong, it probably will. Relax; it's a normal part of engineering.
- Make it *robust*. It should work every time, even after being transported, stacked and stored.
- Pack repair materials into your box for the day of the competition (tape, fresh batteries, scissors etc.) You will not be allowed to use anything that was not impounded.
- Use the KISS philosophy: Keep It Simple, Student. Fewer things can go wrong.