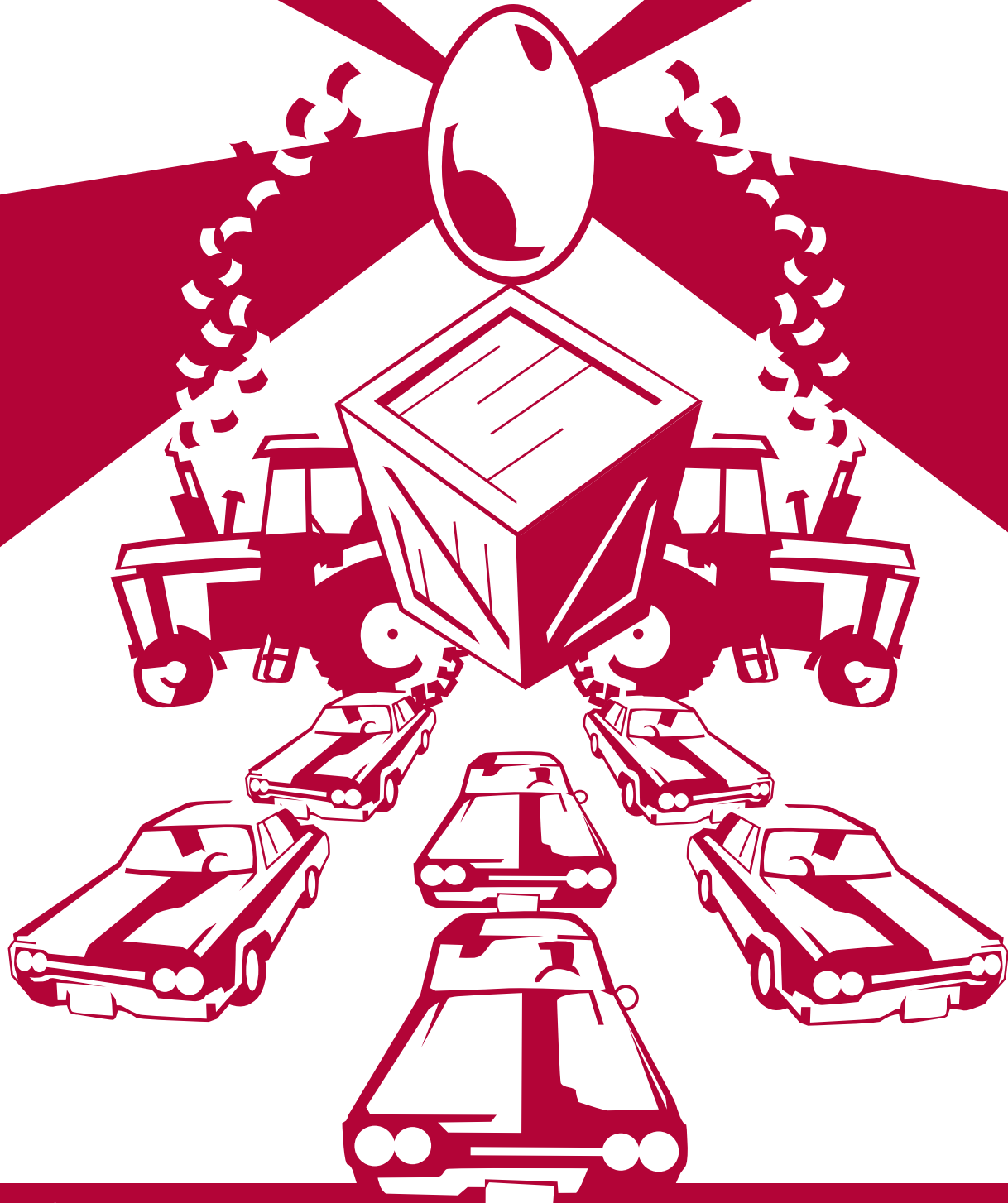
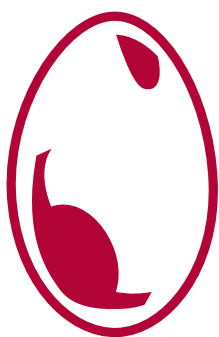


5TH ANNUAL HIGH SCHOOL COMPETITION



Christian Brothers University
SCHOOL OF ENGINEERING



EGG DROP COMPETITION

We handle packages in one form or another every day. Without packaging, our standard of living would fall far below present levels. Most of us are unaware of the science and engineering that go into making packaging materials. Packaging engineering is a comparatively new interdisciplinary field in which scientific and engineering principles are applied to develop and produce packages that contain, protect, preserve, inform, and sell a product.

The goal of the contest is to design packaging (box and packing) to contain and protect raw chicken eggs from breaking when dropped from a height of 40 feet and more. Soft, crushable packing that encloses a lot of air is best. Foam rubber or plastics, feathers, cotton, or synthetic batting are all good "cushioners." Think of materials that are soft and yielding and light. What soft and fluffy materials could be used? How can the weight of the package (box and packing), as well as the volume of the box, be minimized?

Each package may be tested several times at increasing heights in order to determine first, second, and third place winners. Last year's winning height was 68 feet!

RULES:

1. Weight of package (without the egg) must not exceed 1 lb.
2. Maximum volume permitted is 250 cubic inches. For shapes other than circular, volume = cube of the second largest dimension.
3. No glass or other materials that shatter.
4. No sharp edges.
5. No parachutes, helium, wings, etc., are allowed to slow down the fall.
6. Contestants are to bring their packaging to the event. No materials will be provided on-site for building.
7. No commercially built packaging (injection molded, or thermoformed in the form of blisters, clam shells, etc.) may be entered. Materials commonly available (plastics, Styrofoam, paper, wood, cloth, etc.) may be used in the construction of the box and packing (packaging).
8. Discoloration of the egg due to packaging will lead to disqualification.
9. Containers must include an opening for insertion of the raw egg and checking for breakage by the event staff. The time allowed for insertion of the egg into the packaging is limited to 60 seconds.

JUDGING CRITERIA:

The competing packages will be tested with raw Grade A Large size chicken eggs supplied by the CBU School of Engineering. If more than one package survives the highest drop, they will be scored as follows:

- Maximum height survived/weight of package – 65%
- Compactness (volume/weight) – 25%
- Aesthetics (how it looks) – 10%

For more information, please contact Dr. Asit K. Ray at aray@cbu.edu or (901) 321-3418.



CO₂ CAR COMPETITION

Cars, airplanes, and rockets all have engines that work by converting chemical energy to mechanical energy. Exercise your chemical and mechanical engineering potential by designing a vehicle powered by baking soda and vinegar. The one that goes the farthest wins!

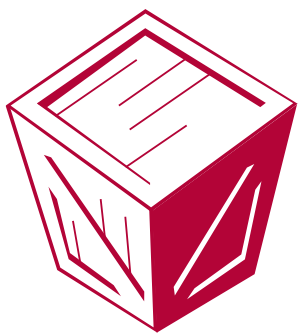
Baking soda and vinegar combine to produce carbon dioxide gas. If the CO₂ is directed through a nozzle, the thrust produced by the nozzle may be used to move a vehicle (car, sled, etc.). Your vehicle must transport a "load" (a raw Grade

A large egg) intact, in a specified direction, and over a hard surface such as asphalt, tile, concrete, or brick. The test course may be slightly inclined or uneven, but it will have no drop-offs or ditches. It may be outdoors and therefore subject to wind, moisture, small debris, etc. Each vehicle will be permitted a maximum of two attempts to navigate the course. Vehicles will be judged based on the distance they travel within the course confines. The winning vehicle will be the one with the single best run. Ties will be settled using the average of the runs a vehicle made.

ADDITIONAL RULES:

1. Contestants must design and build their own vehicle. Published designs or purchased kits are not permitted. Components of the vehicle, e.g., wheels, may be taken from models or toys, but they must be combined in such a way to create a new vehicle.
2. All designs must travel a minimum of 6 feet.
3. The load must arrive unmarked and undamaged.
4. For each run a vehicle may use no more than 2 cups of vinegar and 1/2 cup of baking soda. The correct amount of vinegar and baking soda, and their proportions, will vary based on the design. Vinegar and soda will be provided at the competition.
5. There are no restrictions on the size or weight of the vehicle.
6. A starting line and starting point will be used. All vehicles must start completely behind the starting line.
7. The course is defined as the area within an arc of 20° to either side of the starting point.
8. The travel distance will be measured as the linear distance between the starting point and the front of the vehicle. If the vehicle travels outside the course boundaries, the travel distance is defined as the linear distance between the starting point and the point where the front of the vehicle left the course.
9. Vehicles must be self-contained. No sort of starting block or launch pad may be used.
10. A maximum of 45 seconds will be allotted to load the egg, load the fuel, and launch the vehicle.

For more information, please contact Dr. Ali Pourhashemi at apourhas@cbu.edu or (901) 321-3401.



CRATE COMPETITION

BALSA

Sponsored by Medtronic Foundation

Crates are used to transport goods from one location to another. Often they are stacked on top of one another, and so must be strong enough to protect their contents.

The Department of Civil & Environmental Engineering and the Packaging Program at CBU invite all high school students to build a balsa wood crate and test its strength.

RULES:

1. The design must be constructed entirely from 1/4 inch (1/4 inch square cross section) balsa wood. Balsa wood members shall not be coated or treated in any way. Crates made from wood other than balsa wood will be disqualified!
2. Elmer's white glue must be used to join members. No other glue will be allowed. The glue must be placed only in the contact areas of members and excessive accumulation of glue at joints will not be allowed. Crates using glue other than Elmer's white glue will be disqualified!
3. Gluing members together to achieve members with larger cross sections is not allowed. Individual members with other cross sections are not allowed.
4. The exterior dimensions of the crate are a 6 inch x 7 inch footprint and 5 inch height with an acceptable tolerance of 1/8 inch.
5. You must include an opening of 2 inch square (clear interior spacing with 1/8 inch acceptable tolerance) on the top side of the crate. The opening can be anywhere on the top side of the crate.
6. The crate is designed to contain a product inside, so interior bracing is not allowed.
7. A letter from a school teacher (a parent for home school) certifying that only balsa wood and Elmer's white glue are used must accompany each crate.

JUDGING CRITERIA:

1. After checking dimensions, the crate will be weighed on a scale.
2. Each crate will be crushed to failure in a compression machine.
3. The crate efficiency will be computed using the following equation:
$$\text{Crate Efficiency} = \frac{\text{Maximum Load (lbs.)}}{\text{Crate Weight (lbs.)}}$$
4. The crate with highest efficiency wins!

For more information, please contact Dr. Pong Malasri at pong@cbu.edu or (901) 321-3419. Also, visit www.cbu.edu/engineering/packaging/2007BalsaCrates for similar contests, photos, and additional information.



PULL COMPETITION

TRACTOR

Engineering problems frequently require the design of controlled systems with conflicting demands for load, speed, force, energy consumption, rate of energy release, and so forth. The Department of Electrical and Computer Engineering (ECE) challenges you to design, construct, and assemble a "tractor" that demonstrates such a system.

RULES:

1. The contest space is a 4-foot by 8-foot type AB plywood surface with smooth side painted.
2. Each vehicle will be powered by a dc motor identified by Jameco part number 231802CG, product number PC-130F-10370, Jameco catalog 264 (November, 2006), page 175, or at www.Jameco.com on the internet. The dc supply is a 9-volt battery identified by manufacturer and number as Duracell coppertop (9V2). The motor, battery, and vehicle with all required attachments are to be provided as a completed assembly by the contestant at the time of the contest.
3. Each vehicle will have a coupling bracket attached to the rear of the vehicle on the centerline. The bracket will have a horizontal surface extending 1/2 inch from the rear of the vehicle at a height of 1/2 inch above the plywood surface. The horizontal surface will have a drilled hole sized to accept a number one Gem paper clip.
4. The design of each vehicle must show significant contribution by the contestant. At a minimum, the power transmission from the motor shaft to the drive wheels must be from components selected, purchased, and assembled by the contestant. Specifically, a vehicle must not be purchased as a completed item.
5. Each contest begins with a starting light activated by the referee. Each vehicle must include a pushbutton to begin the pull. The pushbutton must be activated by a vertical, downward, movement. A default occurs when a contestant activates the pushbutton before the referee activates the starting light. A second default eliminates the contestant.
6. A winner is declared when any part of an opponent's vehicle has been pulled 10 inches from the starting line.
7. If, during a pull, either or both vehicles leave the contest space, a default occurs. A second such default eliminates the vehicle which first left the contest surface.
8. Answering questions, interpreting rules, settling unexpected problems and making the final decision in any pull rests with the judging panel.

Entry Forms and \$5.00 Entry Fee per student-event must be postmarked by Friday, March 23, 2007
Partners may enter, but both participants must enter and pay the entry fee.

For more information, please check the website at www.cbu.edu/engineering or email HSCompetition@cbu.edu

PRIZES:

\$150, \$100, and \$50 will be awarded respectively to the First, Second, and Third Place winners of each of the four competitions.

SPONSORS:

Barnhart Crane & Rigging Co.; Medtronic Foundation; and CBU School of Engineering

TEACHERS & GROUP LEADERS:

If you would like a CBU Engineering Professor to visit your class and discuss the competitions, email HSCompetition@cbu.edu or phone (901)321-3405

Christian Brothers University
SCHOOL OF ENGINEERING

650 East Parkway South
Memphis, TN 38104
(901)321-3405