

The Egg Smash

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Type: Design Project
Length: 6 weeks
Location: Take Home

Summary

This ice-breaker project places first year students in a WIN-WIN situation. A raw egg is placed 8 ft. from a 2" by 6" wooden barrier 8 ft. long. Student teams are to design and construct a means that will pick up the egg, transport the egg, and deposit the egg (unbroken) to a spot 8 ft. on the opposite side of the barrier in less than 2 minutes. A testing session in the laboratory provides students with the opportunity to compete against their classmates. This is a FUN project.

With modifications, this project can also be used in a dynamics course.

ABET Descriptors

Engrg. Sci. Content: First Year Engineering, dynamics
Type: Systems
Elements: Establish objectives and criteria, synthesis, analysis, construction, testing, evaluation
Features: Creativity, open-ended, specifications, generate alternative solutions, system description
Constraints: Time, space, human factors, aesthetics
Effort: Team

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A raw egg is placed 8 ft. from a 2" by 6" wooden barrier 8 ft. long. Design and construct a means that will pick up the egg, transport the egg, and deposit the egg (unbroken) to a spot 8 ft. on the opposite side of the barrier in less than 2 minutes.

Limitations and constraints:

- a. No trained pets are allowed.
- b. You can interact with the means only once.
- c. If your means breaks the egg, you
 1. receive a 50 point penalty, and
 2. you must clean up the mess.
- d. For every second late your team loses one (1) point.
- e. A run is disqualified if the means hits the wall, hits the ceiling, structurally collapses, or falls over.
- f. Remote control devices are not permitted.

Each team will receive 50 points if the means can pick up the egg unbroken. Each team will receive additional points if the egg is unbroken and is transported:

Across the barrier	50 pts.
To within 4 ft. of the target	100 pts.
To within 2 ft. of the target	150 pts.
To within 1 ft. of the target	200 pts.
To within 6 in. of the target	250 pts.
To the bullseye	350 pts.

Penalty points are awarded if:

Will not put the egg down	-50 pts
Late: per second	-1 pt.

Submit a design report after three weeks. This reports should include the following:

- a. Problem definition
- b. Limitations and requirements
- c. Preliminary ideas (sketches and brief description)
- d. Final design (sketches and detail parts list)
- e. Path of the egg transport

Submit the constructed means after six weeks for testing and evaluation.

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Engineering Notes

Objectives/Comments:

This project should be a FUN project for the students. The fly-off competition at the end of the project can be a WIN-WIN affair with the students having fun regardless of the outcome. This project will provide a good ice-breaker in the first year class, providing students with the opportunity to meet their new classmates.

Expected Outcomes:

Design Process. The design team must follow a logical process in accomplishing their design. This design process must be reflected in the design report submitted by the team.

Design Report. Each team must work together to develop documentation on the design. The design report will reflect the steps taken in the design process used in solving the problem. Grade evaluation should be more heavily weighted to the report and the design concept generated in the report, than to the final product.

Final Product. The final product developed by the team should reflect the work presented in the report submitted three weeks earlier. Any significant changes in the design of the product must be justified by the design team. The quality of the final product may vary widely depending on the background of the design team, the difficulty of the concept, and other constraints. Many of the deficiencies of these products can be resolved later in the student's academic career. For this reason, a smaller portion of the student grade is allotted to the product construction and performance.

Team Dynamics. This project requires the team to develop in the design report a solution which the group must replicate later. Locking ones self into a paper design before construction begins requires the team to "plan ahead." In a first year class the instructor may wish to provide some time for meetings and guidance to the teams so that the pace of the project work is steady. Early team dynamics may be strained but interaction increases as the construction of the test means proceeds. Maximum team interaction occurs during the testing competition. The instructor can enhance the team dynamics by spending some time in class evaluating what is happening in the teams. In many cases students remember this team experience (including team members) when they are seniors, or even when they are returning alums.

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Discussion/Follow Up:

The word “means” is used to provide the designer the maximum latitude in creating a solution. If the word “vehicle” is used then the solutions are limited to vehicles, and students from non-vehicle related disciplines may be at a disadvantage. Using the term “means” in the problem description permits student creativity to investigate not only vehicles, but structures, rotating cranes, fluid power, etc.

Substitution of “vehicle” for “means” will make the project more suitable for a dynamics course later in the curriculum. In this course students should be expected to produce a more detailed report and a better product for test.

Solutions to this problem can be as varied as the student population. Some typical solutions include:

- Small battery-powered vehicles with scoops on the front to capture the egg travel in an arc around the barrier to destination
- crawl over the barrier in a direct line to the destination

- Rotating cranes with a structure which straddles the barrier; battery powered arm rotates from starting point to destination; scope at end of boom
- rotates egg around end of barrier
- lift egg up and over barrier as it rotates

- Ski lift structure with a scoop mechanism that picks up the egg, transports it via a belt driven system over the barrier and delivers it to the destination.

- Dynamically powered, rolling vehicles which move around or across the barrier to deliver the egg to its destination. Power is generally furnished through a falling weight.

And anything else that does the job!

Students at the first year level can encounter problems with construction of the product. With limited experience in shop practices, final products may not always work as anticipated. This can be frustrating to the student. As with any life experience, the product building will improve as the students gain maturity, not only in shop practice but in improved engineering science background.

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The testing session provides proof of the paper design. It also demonstrates to students that in real life the result does not always follow the prediction of theory. This is a good time to remind students that

Equations, tables and curves are only a mortal's representation of reality

Other appropriate thoughts include:

The man with a new idea is a crank until the idea succeeds - - Mark Twain

An ounce of application is worth a ton of abstraction - -Booker T. Washington

What we have to learn to do, we learn by doing - - Aristotle