

**Introduction to Engineering**  
**Design Problem I**  
**College of Engineering Pumpkin Transport Design Competition**

**Purpose**

The purpose of this design project is to transport a pumpkin the furthest distance with the highest degree of accuracy, thus enabling the pumpkin to take out or damage one of the Sheriff of Nottingham's castles. The pumpkin weapon must be transported from a prescribed launch area across the Sherwood Forest Green to one of three possible sheriff castle targets. The closest castle (200 feet) is a forward lookout castle, the next castle (600 feet) is a troop quarters' castle, and the furthest castle (1320 feet) is the sheriff's headquarters and honor guard castle. The three target pumpkins will be supplied by the instructor or the student team. If a delivery vehicle is used, the pumpkin must be situated in the vehicle by the student team prior to launch of the transport vehicle to its intended landing location. The winner will be declared by a point score that is a combination of which of the castles the pumpkin landed at, or near, and how much damage was done to the castle by the pumpkin weapon. In the event of two vehicles traveling the same distance and doing the same damage, the winner will be determined as the one getting to its target zone the quickest.

**Use of a Pumpkin Transport Vehicle**

A transport vehicle can assume any form, projectile, aircraft, airship, parasail, or any combination of these forms. The vehicle is not, however, restricted to an airborne vehicle. The vehicle can be an over-the-land vehicle. If the vehicle is a land base vehicle it must proceed to the intended destination in a straight-line path from the launch area and deliver the pumpkin weapon to the castle. The transport vehicle can be no larger than 50cm wide by 50cm deep and 75cm long. The vehicle may not be a suicide weapon...that is... it cannot crash into the castle with the pumpkin in the vehicle. It must be a pumpkin launch vehicle. The pumpkin must inflict the damage to the castle. The delivery vehicle, while in en-route to the target castle, may assume dimensions of up to 1000cm by 1000cm by 2000cm, but must be within the original 50x50x75cm envelope upon arrival at the castle for pumpkin weapon delivery. The vehicle can have as many removable or fall away parts as necessary, but at least 51 percent of the vehicle, by weight, must be intact at the time of landing. The vehicle can weigh no more than 3 kilograms at the time of launch. The transport vehicle can contain no more than 2000-watt hours of energy onboard at the time of launch. This energy can take the form of electrical, compressed gas, chemical (other than gasoline or an aromatic petroleum based product) or spring storage. The vehicle, if it uses chemical energy, must not be on fire at the time of launch, as an unintentional landing (i.e. a crash) can be considered as hazardous and could result in the vehicle being disqualified. The transport vehicle shall not make use of any hazardous materials or substances that could harm members of the team or any other team, i.e. acid, caustic, or biochemical substances etc.

Notice: The pumpkin weapon does not have to make use of a transport vehicle to get to the sheriff's castles. If the pumpkin weapon can be successfully launched from the launch area without the aid of a transport vehicle, then such an assault on the castle is legal. However, all of the rules as to fire, hazardous materials or substances also apply to a singular pumpkin launch.... For example.... the pumpkin cannot be on fire at the time of launch.

### **The Launch Platform**

The launch platform must be a compliment to the transport vehicle or pumpkin weapon. A launch pad is not required if a team's device does not require the use of a launch pad or device. If the transport vehicle requires a platform or device it must be of such size that it can be easily carried and assembled by the students at the intended launch site. This platform or device must be removed from the launch area following the launch of the team's vehicle or pumpkin weapon. The launch platform can weigh no more than 150 kilograms. The platform can take the form of a catapult, rail gun, gaseous vehicle launch pad, cannon or other such device. The launch device must be no larger than 10 feet by 20 feet when deployed. This launch platform shall not damage the launch area and will serve to protect it from any substances that would be harmful to grass or other living things. The launch platform shall not make use of any hazardous materials or substances that could harm the students of the team or any other teams. The sole judge of what is considered hazardous will be the instructor or the graduate student operational team.

Each of the pumpkin weapon systems must be inspected by the instructor and or the team judges' council. The launch system must be considered safe to operate by the inspectors. In plain language the launch system must not pose a hazard to any member of the team, any other team, spectators, news media, or instructors. If the project is considered hazardous, then it is subject to disqualification and cannot be used. If the project can be made safe by the project team and it can be shown to the instructor of the course that it is safe then the vehicle can be launched under agreed to guidelines.

### **Test Criteria**

Each vehicle will only be given three, for a grade, launches. These launches will be determined by the individual teams. Once a team has determined it is going to launch they must advise the instructor or one of the graduate assistants. After launch, the weapon or transport vehicle must safely make its way to the prescribed landing area. The intended landing area must be specified by the team to the officials conducting the contest before the launch. This landing area must be specified as within the zone of play and cannot cross over an out of bounds area. An out of bounds area is an area that vehicles and launch pads are not permitted to enter, nor are the vehicles permitted to enter the airspace of the out of bounds areas.

After each transport vehicle, or weapon has been launched a timer will be started in order to determine the time of travel. The timing will only be used in case of an equal score of cumulative points. Upon landing of the transport vehicle or pumpkin weapon the

distance from the launch point to the landing point will be measured. The score for each round will consist of two components: 1) the distance traveled in feet; and 2) the value of the castle that is struck, if such is the case. The score is the sum of these two components. Castles are scored in the following manner. The closest castle is worth 1000 points, the middle castle is worth 2000 points, and the headquarter castle is worth 4000 points. Castle points are awarded when a pumpkin weapon hits or knocks down a portion of the target castle. If bricks are knocked off a bonus multiplier will be used equal to one plus the number of bricks dislodged. That is...if you knock off one brick your castle score will be multiplied by two, and if two bricks are knocked off, the castle score will be multiplied by three... etc. Obviously, if a castle is not hit, the castle component of the score is zero. Once a brick has been knocked down or off, the brick is no longer available for scoring by another team. That is you get no bonus multiplier if you hit an already destroyed castle. If the distance is less than 25 feet, a distance of zero will be used to compute the score. This is done to prevent a vehicle from moving 1 inch in a small time and thus producing a bogus score that is contrary to the spirit of the contest.

Each team will be given three shots at the castle complex. The team's score is the sum of all the points that were accumulated by the three attempts. Ties will be determined by the cumulative shot times. The teams will each be given three practice shots with their own pumpkins, if needed, in order to sight or calibrate their weapon system. No more than three practice shots will be used by each team unless special circumstances dictate.

The pumpkins may be launched singly or in groups. Pumpkins launched in groups shall be considered a single shot. The pumpkins may be modified in any manner as to improve their aerodynamic performance. They may not be modified in order to improve their hardness or density...that is no mixing the pumpkin with epoxy or Portland cement etc.

Each of the project teams must meet with the instructor or the graduate student launch team at least one week prior to the actual testing and explain in the form of documents, pictures, and oral explanations how the system works, what are the safety issues of the project, and how the team has addressed each one. If the instructor deems that additional safety precautions must be employed, they must be addressed by the team. **NO ONE MUST GET HURT IN THIS EXERCISE.... THERE IS NO NEED.**

Time of test start is 10:30 am on Thursday October 28<sup>th</sup>, 2004. This time is subject to change due to weather. An alternate weather date is Tuesday November 2<sup>nd</sup>, 2004. The place of the test will be determined and given to the class before September 10<sup>th</sup>, 2004.

## **The Report**

The report format will be explained in class called project report.

Each of the transport systems must be supplied with a complete cost breakdown. The cost breakdown must include a valid retail price for each of the items on the list (nothing is free).

The report must contain documentation detailing the method by which the vehicular system was conceived, the method of manufacture and any results of previous tests conducted on the vehicle prior to the actual test. The report must contain the valid justification for the fuel and energy converter that is on board the vehicle or the launch pad. The justification must contain cited references on the energy content of the fuel, design drawings on the converters, or paperwork on purchased components.

The report must be supplied in a typed or word-processed form. The report should be on 8½ x 11 plain white paper with a title page, executive summary, table of contents, main body, conclusions, and references. The report must be in a folder that holds all of the pages of the report in a secure manner. The report including figures must be a minimum of 17 pages. The report must be turned in the class period after the test of the project. If the report is a joint report then the names of each member of the team must appear on the report.

The report is due the class period following the tests.

**Grading Criteria:**

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| 1. | Success of the test (did it work)       | 40% |
| 2. | Report of the design                    | 40% |
| 3. | Judging of the innovation of the design | 20% |

**Prize Scoring:**

First, Second, and Third place will be determined by the total points accumulated by the individual teams. Prizes will be awarded based on team placing.

**Notice:**

The specifications in this document are subject to change or modification within the first two weeks of the design period. The changes need not be submitted to the individual students in writing but may be given orally in class.

Questions can be directed to

John E. Fagan	<a href="mailto:jfagan@ou.edu">jfagan@ou.edu</a>
John Dyer	<a href="mailto:jwdyer@ou.edu">jwdyer@ou.edu</a>
Andy Archinal	<a href="mailto:andy@ou.edu">andy@ou.edu</a>

School of Electrical and Computer Engineering  
Carson Engineering Center 213