

Trebuchet Competition - Brief

Project Description

An engineering exercise that illustrates the requirements and challenges inherent in larger design projects. Team experiences will include: converging on a design, understanding constraints, designing within constraints, keeping to a project schedule, and actual building and testing of the product.

Project Objectives

1. To provide experience in engineering design
2. To provide hands-on experience in building a project
3. To provide experience in testing and analysis
4. To provide experience working in teams
5. To provide experience in team communications
6. To have fun

Project Guidelines

Design deliverable: A trebuchet that hurls a provided projectile to land as near as possible to a target zone 40-60 feet away.

Trebuchet Design and Performance Requirements

- The throwing object, referred to from this point forward as ‘the projectile’, will be a cloth covered ‘water skip ball’ measuring approximately 2 1/8” (~54mm) in diameter.
- All trebuchets will be constructed mainly from wood (provided). Other materials may include plywood (gussets), 3D printed components (bushings) and metal (pivot bars – 1” EMT)
- All Trebuchets must fit fully assembled through the exit door (next to the grinder) in the shop. Maximum height of a trebuchet, not including launching arm is 5’
- The trebuchet must be manufactured to be easily disassembled allowing for ease of storage between classes.
- The trebuchet must follow trebuchet design principles, i.e. the projectile must be hurled using a counterweight to activate the throwing arm and separately attached projectile basket. No slingshots or catapults allowed.
- All trebuchets will use the same counterweight method. This is to be a 4 litre milk jug filled with water. The water level may be adjusted as needed.
- All trebuchets must be free-standing. Teams may not stake down the trebuchet.
- All trebuchets must have a trigger/release device that allows the team to launch the trebuchet from at least seven feet away (at a diagonal to the trebuchet, not directly behind).
- Supplemental ejection systems such as compressed gas, fire, water, etc. are not permitted.
- All teams will demonstrate the performance of their trebuchets at the “Trebuchet Competition” that will be held outside behind the shop, at a date to be determined.

- The trebuchet must demonstrate accuracy by hitting a ground target at a distance of 40-60 feet. The exact target distance will be constant on the day of the trebuchet challenge, but will not be announced until the trebuchet challenge begins. Points will be awarded for accuracy.
- Bonus: a pole will demark the centre of the target zone, hitting this pole will achieve a bonus in addition to a full point value for accuracy.
- The first contact the projectile has with the ground will be taken as the point of measure
- The team is responsible for the full cycle of the design. Therefore, **teams must break down or remove the trebuchet immediately after the “Trebuchet Challenge” and recycle the materials.** This requirement will be strictly enforced and you will not get a grade until your trebuchet is recycled.

Testing

In engineering ‘iteration’ is the name of the game. Design, make, test, analyze, redesign and then repeat. You will likely need many tests in order to dial your trebuchet to achieve the highest level of accuracy.

Project Phases

Research & Design

1. Research common successful designs
2. Make notes on what design elements work best and any pitfalls to avoid (keep these!)
3. Create preliminary sketches (paper and pencil) of your trebuchet design, include dimensions and materials used
4. Using Fusion 360, create a full size 3-dimensional model of your trebuchet
5. Create a series of orthographic drawings (plans) that show the dimensions of each unique piece of your trebuchet. On each drawing note how many of the piece will be needed.
6. Using Fusion 360, generate a presentation drawing (orthographic style) of your trebuchet
7. Submit: Notes, sketches, all ‘plan’ drawings and the presentation drawing for grading

Manufacturing & Testing

1. Build your trebuchet
2. Ask for suitable materials as/when needed (please don’t help yourself to just anything)
3. Test your trebuchet
4. Keep detailed records of each test, the results of the test, along with any observations made and possible improvements needed (these records are to be submitted with your final trebuchet for grading)
5. Prior to competition day, you will submit all records of testing along with the completed trebuchet for grading.

Compete

1. A chance to see how your hard work stacks up against that of others

Reflect

1. Opportunity to look back and learn from all that transpired