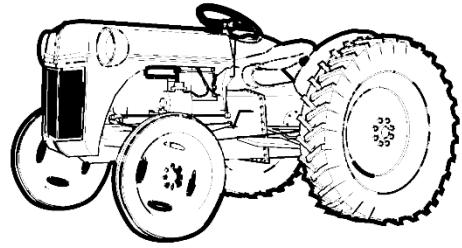


Bakersfield College Engineers' Club
Design Challenge 2017

Tug War



Objectives:

- To provide students and the public with the opportunity to participate in a team-oriented, hands-on design and construction of an engineering-related problem.
- To encourage students and the public to become actively involved in engineering.
- To increase awareness of the engineering disciplines among the general public, industry leaders, educators, and students.

Overview:

Participants will build a tractor and participate in a tug war competition.

Competition Format:

- Tractors may be built by individuals or teams.
- Competition divisions are based on the education/experience level of the participants of the team. See the section on divisions below.
- Teams may enter multiple unique tractors into the competition.
- The competition will follow a double-elimination bracket format.

Divisions:

Division	Maximum Tractor Mass	Pull Distance
Junior High & Below	3000g	250mm
High School	2750g	350mm
College & University	2500g	450mm
Open & Professional	2250g	550mm

Competition Constraints:

- The main design constraint in this competition is the mass of the tractor. A tug war is usually decided by the participant with either the largest mass or strongest pull. In an effort to even the playing field the mass of the tractor used in the tug war will be limited. Refer to the above chart for the maximum mass of your tractor.
- The tractor must stay in one piece during the competition. The use of a launch pad, starting block, or similar device is prohibited.
- The tractor may NOT damage the competition surface in any way. See information on the competition surface and setup below.
- The tractor must stay connected to the cable at all times during the competition.
- After the tractor is attached to the cable the participants must stand outside of the competition area.

- The tractor must be started remotely by means of a starting pin or similar device attached to a string (see *Tractor Design Constraints* for details). The string must be long enough to allow the participant to stand outside the competition area when starting the tug war.
- The tractor may NOT sabotage the opponent by shooting projectiles, spraying the competition surface with any substance, or similar activity.
- Once competition has begun, the tractors must be autonomous.

Tractor Design Constraints:

Materials:

- Any materials may be used in the design and construction of the tractor including wood, plastic, or metal, including commercially-available components such as Legos, K'NEX, Erector, *etc.* Commercially available gears, wheels, and axles are all acceptable.
- The power source may be any *safe and suitable* means including, but not limited to, springs, rubber bands, mouse traps, or by using the potential energy released by a falling mass.
- The use of electric motors is limited to the *College & University* and *Open & Professional* divisions. If electric motors are used they must be “built from scratch” as no commercially-produced motors are to be used. If an electric motor is used in a design the power source must be installed on the tractor and included in the overall weight of the tractor.
- Any tractor powered by an electric motor must have a push-button emergency stop shut-off switch that is easily identifiable, easily accessed, and demonstrated to the judges before competition begins.

Tractor Size:

- There is no constraint on the tractor size except that it must be able to be positioned on an electronic scale that measures approximately 300mm x 300mm square.

Hitch Location and Specification:

- The hitch shall be a hole, closed loop, or eye that will accept a 1/8” quick link (see cable and connection description).
- The hitch for the cable shall be located at least 30mm but no more than 45mm above the competition surface.
- The hitch may be oriented either vertically or horizontally.

Starting Mechanism

- In order to insure the safety of the participants and the integrity of the competition, a starting device must be used. The starting device will allow the tractor to be started from outside the competition area.
- Acceptable starting devices include pins or clasps attached to a string or cable.
- So that removal of the safety pin may not result in an unfair advantage in the competition, the pin must be removed in a direction perpendicular to the tug war. If the judges determine that the intended direction of the tractor was altered by the removal of the pin the contestant will be disqualified.
- If a contestant (in the College & University or Open & Professional divisions only) elects to build a tractor with an electric motor, the pin may consist of a device that closes the electric circuit or a radio-controlled servo that would close the circuit.

Competition Arena:

- Refer to the attached diagram and the *Divisions* table for exact dimensions.

- The competition will take place either a concrete or waxed floor surface. Before the competition the surface will be swept clean. The lines marking the starting line and limits of the neutral zone will be made with masking tape.
- There will be a safety zone around the competition that will be off-limits to all competitors during the tug war.

Cable and Connection:

- The cable will be a 1/16" coated cable. The cable will have a 1/8" quick link at each end. The length of the cable and links will be 1200mm from end-to-end.
- A flag will be attached to the center of the cable.

Competition:

- Teams will connect the tractors to the cable and place them in the competition zone so that the starting flag is over the centerline and the cable is aligned with a line perpendicular to the starting line. At this time the safety pin will be engaged and the competition will be ready to begin.
- Because a representative of the Engineers' Club will be responsible for starting the tractor, the team must instruct the Engineers' Club representative on how the tractor will be started.
 - The use of a representative from the Engineers' Club will help to ensure that the competition will be a fair as possible.
- The total time allowed for setup will be two minutes.
- When both tractors have been placed and all participants are outside of the competition area, the judge will begin the countdown to begin the competition.
- The judge will announce, "Ready, 3, 2, 1, Go!" to initiate the tug war. The Engineers' Club representative will pull the starting pin on the command, "GO!"
- After the competition has begun, the total time allowed for the competition will be 60 seconds.
- The winner will be the tractor to first move the flag out of the neutral zone. Once the flag has moved out of the neutral zone the competition is over.
 - If neither tractor is able to move the flag out of the neutral zone within the 60 second period, the winner will be the tractor that moves the flag furthest in its direction of travel.
 - In the case of a draw, the winner will be determined by the flip of a coin.
- On the day of the competition, all decisions by judges are final.
- Any questions regarding the competition should be directed to:

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