

# TCC Engineering Club Design Contest

## Motorized Cable Car

Friday, April 20, 2012, 12:00 - ?

Revised:  
11-28-11

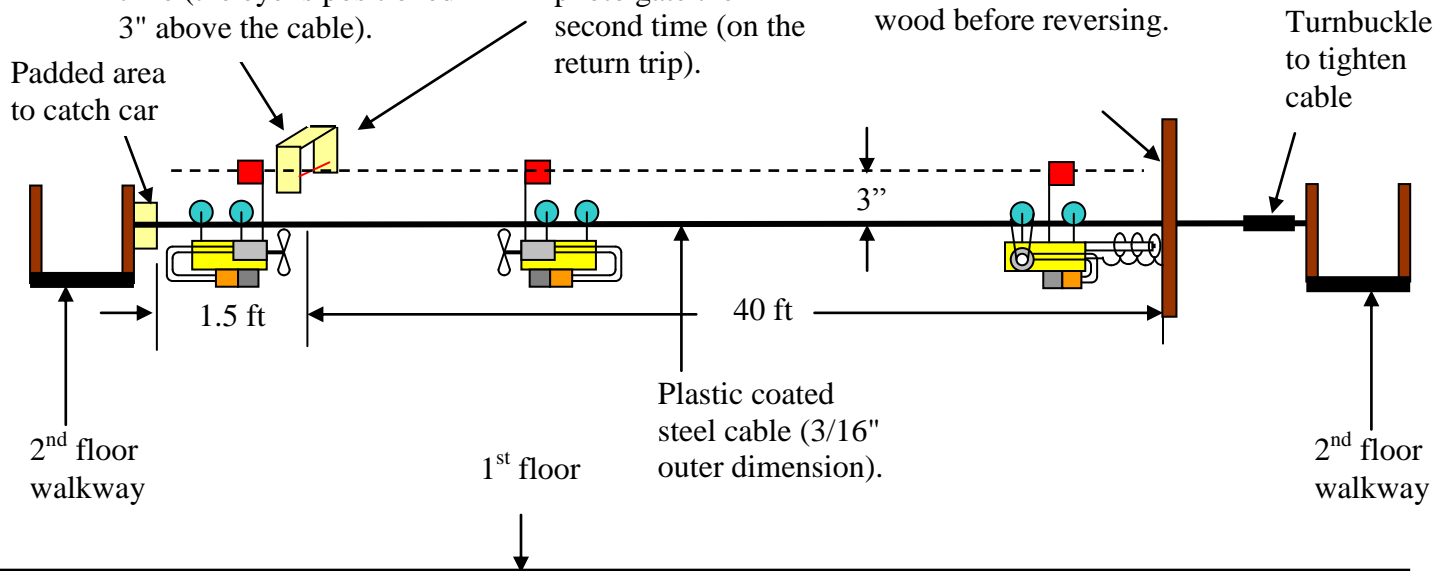
**Location:** The competition will take place in the Advanced Technology Center (ATC) main hallway (the cable will run between two of the upper walkways).

**Cable setup:** (not drawn to scale)

**Starting Position:** Timer starts when flag passes through photo gate the first time (the eye is positioned 3" above the cable).

**Ending Position:** Timer stops when flag passes through photo gate the second time (on the return trip).

**Reverse Direction:** The cable will run through the center of a heavy piece of plywood (at least 12" x 12" x 1/2"). The car must touch the wood before reversing.



### Object of the contest

- Build a vehicle that is powered by a 9V battery and a specified motor from JameCo Electronics.
- The car must travel from the starting line to the end of the cable, bump into the wood at the end of the cable, and return. The cable is about 40 ft long, so the car will travel a total of about 80 feet.
- The timer begins when the car's flag breaks the beam in the photo gate the first time.
- The timer stops when the car completes the course and breaks the beam a second time.
- The car that completes the course in the shortest time wins.
- Detailed contest rules are provided below.

### Parts kit

- May be purchased from Paul Gordy in H-115 (822-7175), Steve Ezzell in H-117 (822-7278), or from TCC Engineering Club officers.
- Includes the following items:
  - 1) JameCo DC motor (12,150 RPM, 6-12V, shaft diameter 0.091", Catalog Number 232039CC, [www.jameco.com](http://www.jameco.com))
  - 2) 1" sample of the cable (to help you properly size your wheels)
  - 3) 9V battery connector (contestants must provide their own battery for the competition)

### **Entry fee**

\$10.00 – includes a parts kit as described below

### **Prizes**

1<sup>st</sup> Place (fastest) - \$75.00

2<sup>nd</sup> Place (2<sup>nd</sup> fastest) - \$50.00

3<sup>rd</sup> Place (3<sup>rd</sup> fastest) - \$35.00

4<sup>th</sup> Place (4<sup>th</sup> fastest) - \$25.00

**Required components** – Every cable car must use the following items:

- JameCo DC motor (12,150 RPM, 6-12V, shaft diameter 0.091", Catalog Number 232039CC, [www.jameco.com](http://www.jameco.com)) – no other motor can be used.
- 9V battery (standard alkaline battery – rechargeable batteries not allowed)
- Only one motor and one battery may be used on the vehicle.
- Each vehicle must include a flag that is centered 3" above the cable and will be detected by the photo gate to start and stop the time.

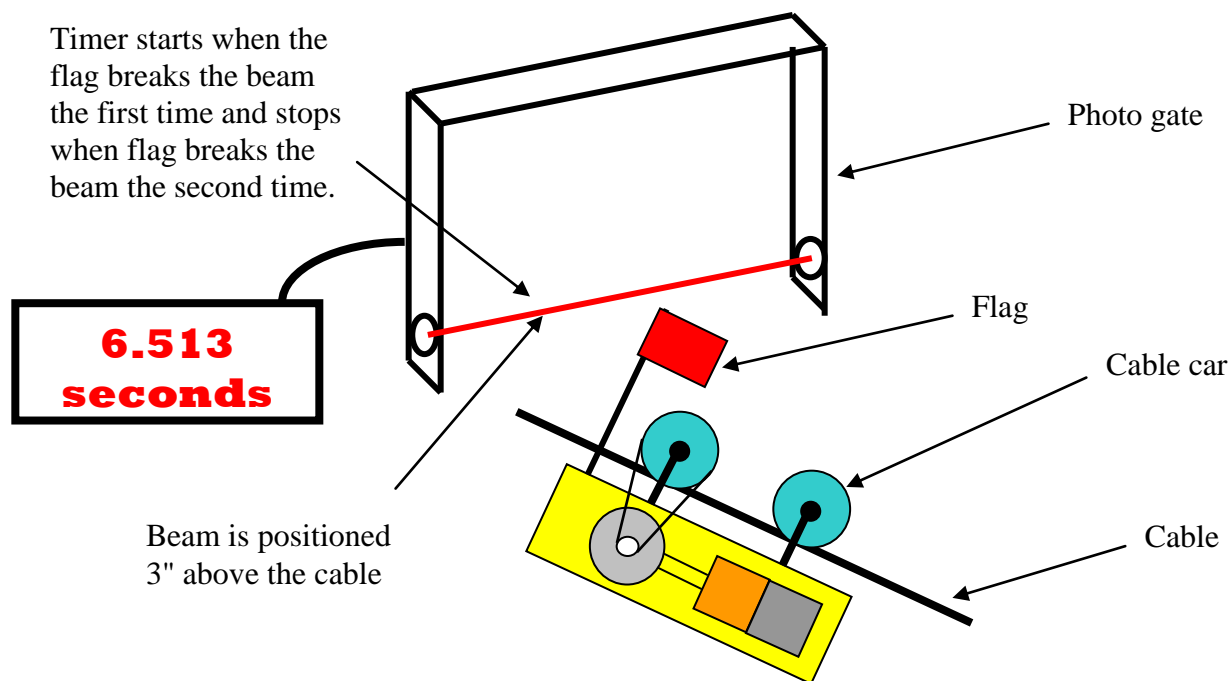
### **More contest rules and notes**

- The contest is open to anyone who wishes to participate.
- Note that the motor turns at a high speed (11,500 rpm). If you are using a gear or pulley driven vehicle, you may wish to use some sort of gear or pulley reduction or the motor will probably not be able to turn the desired load. Propeller driven vehicles, on the other hand, will benefit from the high motor speed. In past cable car contests pulley driven, gear driven, and propeller driven vehicles have performed equally well.
- The vehicle can be no more than 12" in length, 12" in width, or 12" in height.
- No part of the vehicle, except the flag, can extend more than 2" above the cable.
- The center of the flag should be positioned 3" directly above the cable and cannot be more than 4" above the cable.
- The cable will be level and will be "reasonably taut" (tightened with a turnbuckle).
- No additional sources of energy may be used to propel the vehicle (such as additional batteries, pre-stretched rubber bands, pre-compressed springs, balloons, CO<sub>2</sub> cartridges, etc).
- The contestant will place the vehicle on the cable and must be capable of starting the vehicle when a contest official indicates that the timer has been reset and is ready. The timer does not start until the flag passes through the photo gate, so the vehicle may be started at any point before the photo gate.
- An on/off switch is highly recommended.
- The vehicle cannot be interfered with or controlled by any person during the contest.
- Two trials will be permitted per contestant/team if time allows. The trials do not need to be consecutive since the contestant might wish to make repairs or modifications between trials. The faster of the two trials is used to determine prizes.
- If a cable car takes more than one minute to complete the course, the vehicle will be stopped and its trial will be disqualified.
- Contest officials will determine the time each vehicle takes to complete the course and if the vehicle properly completed the course. The judgment of the officials is final.
- Teams may submit a single entry if they wish; however, the team members would split any prize awarded.
- The contest officials will determine the order in which each contestant competes, but will try to accommodate students that wish to participate early or late to avoid schedule conflicts. The competition will begin at 12:30 and will continue until all vehicles present have competed. If a student or team cannot be present for the competition, they may appoint a substitute to run the vehicle for them.
- Sharing of any vehicle components between different contestants is prohibited (except batteries).

- Only one entry is permitted per student or team.
- Contest rules and specifications are subject to minor revision or modification.
- Engineering Club officers (or their appointees) will serve as judges. The judges' decisions are final in case of interpretation or discrepancy.
- Contact Paul Gordy (phone: 822-7175 or email: [PGordy@tcc.edu](mailto:PGordy@tcc.edu)) or Kenny Grimes (phone: 822-7278 or email: [KGrimes@tcc.edu](mailto:KGrimes@tcc.edu)) if you have any questions.
- No refunds are given for any reason.
- The cable will be set up early on the morning of the competition (or possibly the day before) so that students can practice before the actual event. Additionally, watch for announcements as the engineering club may sponsor a practice workshop about a week before the contest so that contestants may practice on a sample of the cable to be used. The workshop will probably be held in H-151 and use a shorter practice cable (12' perhaps). Soldering irons, tools and parts will also be available for contestants to work on their vehicles at this time. The time and date will be announced later.
- Your kit will include a sample of the cable, but if you want to buy a larger piece of cable, it is available from Home Depot: 1/8" plastic coated steel cable (the steel cable has a 1/8" diameter, but with the plastic coating added the diameter is about 3/16").
- You might consider including a design feature to keep your cable car from jumping off of the cable. The cable will be suspended about 20 feet over the floor, so a car may be damaged if it falls.
- Some sort of padding will be placed at the end of the track to stop the vehicles after they pass through the photo gate the second time. Contestants may also "catch" their vehicles after the timer stops if they wish.
- Vehicles might want to consider how to absorb the impact of hitting the wooden board at high speed when attempting to reverse directions. Some possible approaches might include adding springs, foam, etc., to the front of the vehicle. We had a similar competition several years ago and a few vehicles self-destructed when they hit the wall!
- Looking for small pulleys? Old VCR's are a good source.
- Looking for propellers? You might try Debbie's RC World , Hobbytown USA or Hungates.

### **Photo Gate**

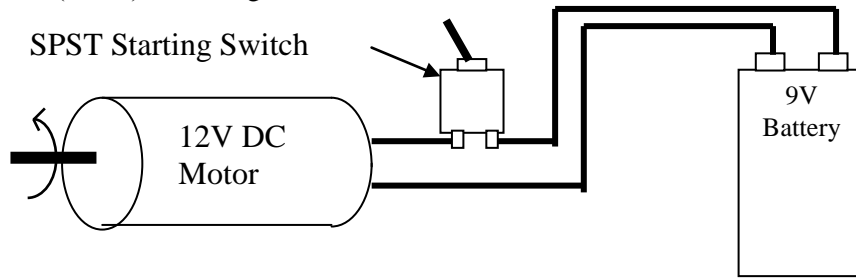
The photo gate operates somewhat like the sensors that stop an automatic garage door from closing when something is in the way of the door. If something blocks the beam, the garage door stops moving or the photo gate starts or stops the timer. A diagram of the photo gate is shown below.



## Helpful Wiring Hints

### Starting Switch

Using a switch is highly recommended to start your vehicle. A helpful diagram is shown below. Any Single-Pole, Single-Throw (SPST) switch will work fine. An example is the Radio Shack “Micromini Toggle Switch” (SPST) – Catalog # 275-624 - \$2.99.



### Reversing Switch

The motor in the kit is reversible. Simply changing the polarity of the battery reverses the direction that the motor turns. One way to reverse your vehicle’s direction when it hits the board at the end of the cable is to use the impact to throw a switch. A double-pole, double-throw (DPDT) slide switch or push button switch might be a good choice. The DPDT switch has 6 connections on it as shown below. (Note: Instead of reversing the motor direction, another option would be to make the vehicle swivel 180 degrees when it hit the board at the end of the track.)

### **Radio Shack double-pole double-throw (DPDT) slide switch**

**Cat. No. 275-407**

**Cost: \$3.29**

