Public

Electric Vehicle 2025

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BEGIN RECORDING

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TASK

- Build a vehicle that
  - Uses electrical energy for propulsion
  - Travels to a target point quickly and accurately

- Impound – yes
- Eye protection - None

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Construction Goals

- Travel 7.00 m to 10.00 m in
  - 0.25 m increments @Invys & Regional
  - 0.10 m increments @ States
  - 0.01 m increments @ Nationals
- And it should
  - Travel straight!
  - Travel fast!
  - Brake well!

(That's all it needs to do!!!)

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Powered By

- Electrical power
  - 8 AA 1.2 to 1.5 volt batteries
  - Common commercially available, labeled
  - Individual, not a battery pack
  - No Lithium or lead
  - Must be impounded uninstalled
    - Extra may be impounded (just in case!)

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Size

Vehicle width must NOT exceed 35.0 cm at ANY point.

Vehicle length: Distance from the “front of the front” wheels and the “back of the back” wheels must NOT be greater than 70.0 cm.

Don’t push the limit! Responsible for lots of penalty points.

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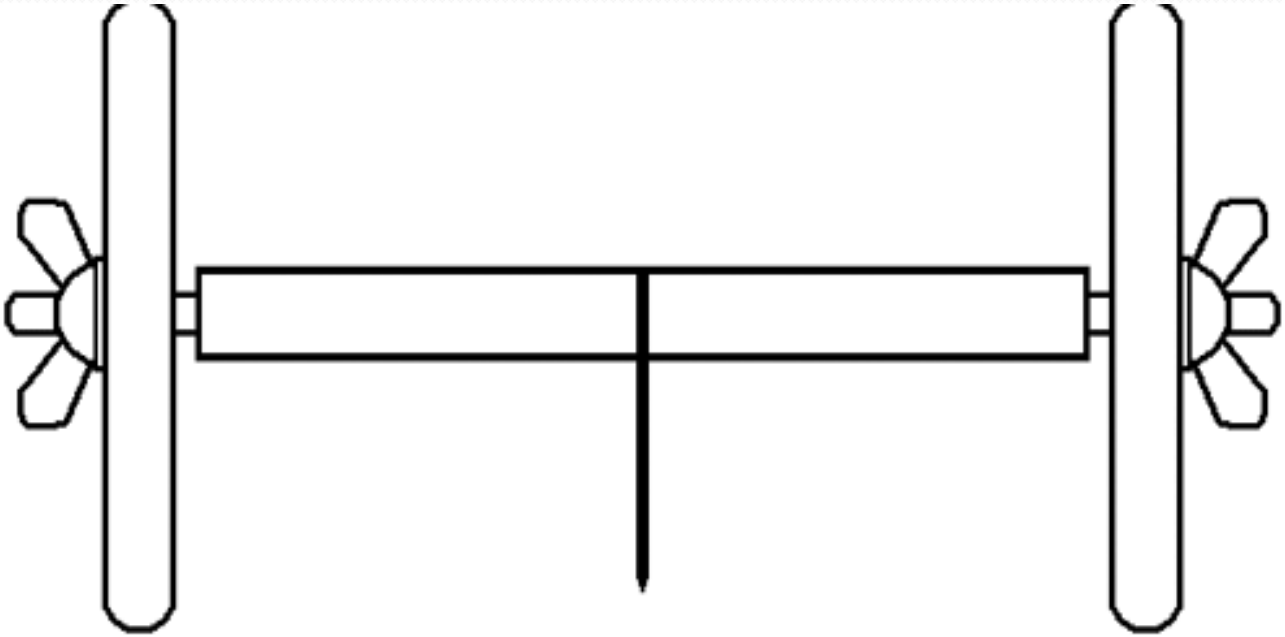
Caution concerning vehicle's width…



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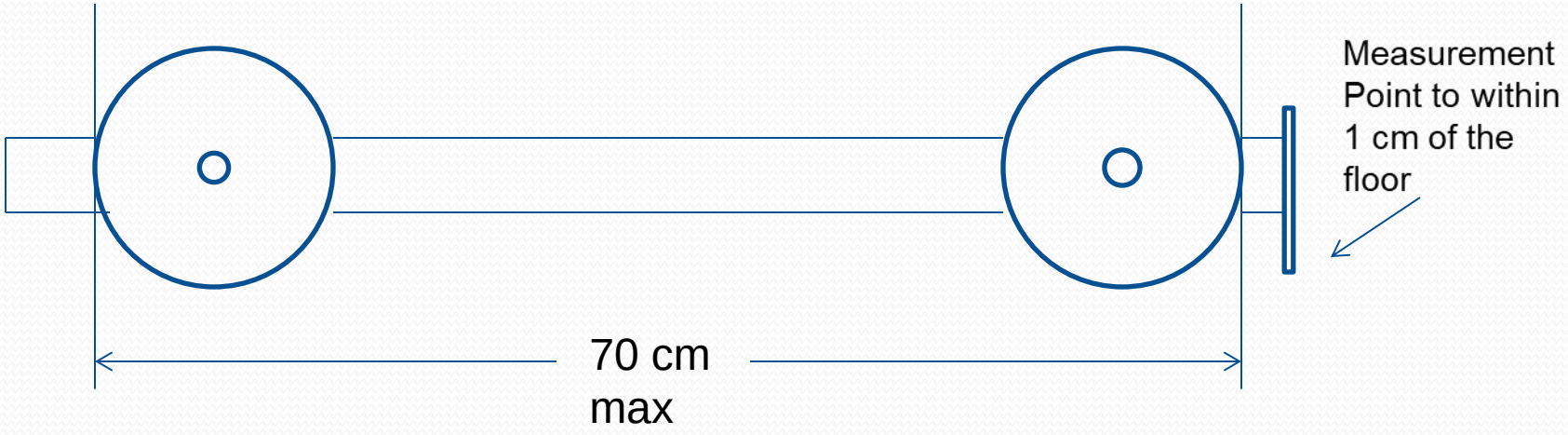
Length



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Measurement Point

- Any material (dowel, paper clip, pencil)
- Within 1 cm of the floor
- Does not have to be foremost point but must be accessible for measurement

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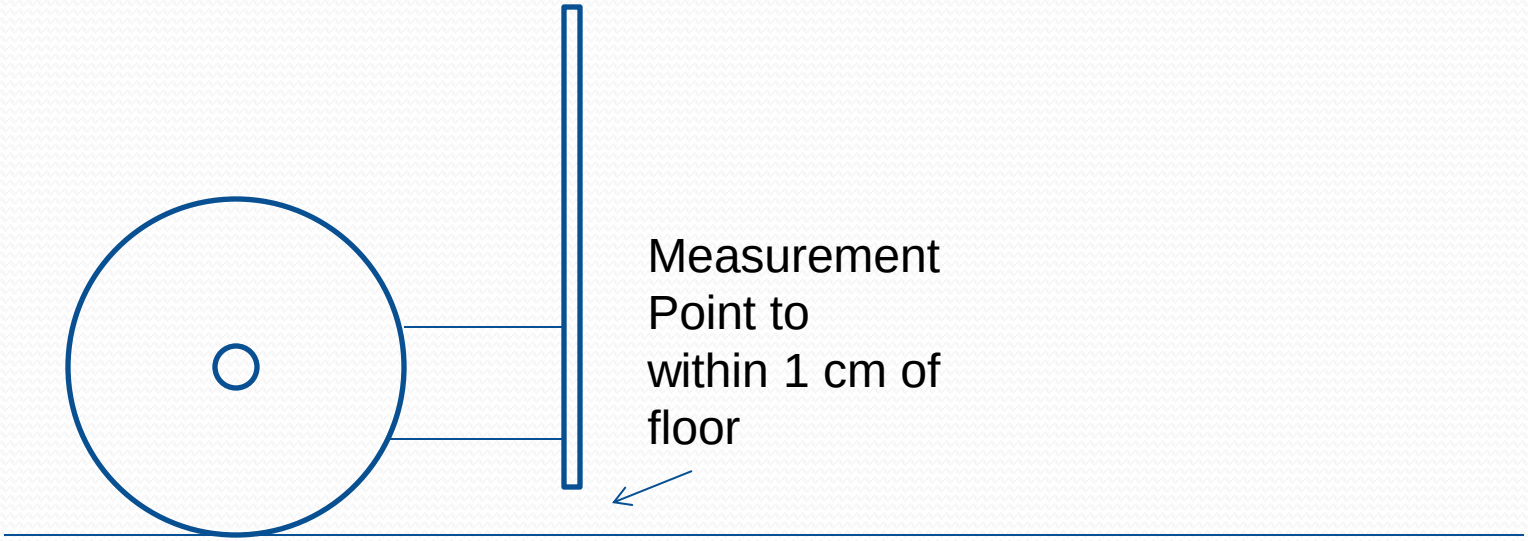
Measurement Point



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Trigger

- Must be designed so that actuation is perpendicular (vertical) to the floor
  - Non-vertically actuated trigger is a Construction Violation
- Students must not hold, constrain, or push vehicle
  - Must be able to remain at starting position without being touched until triggered

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Additional parameters

- All parts must move as a whole
- Laser sighting allowed – See Laser Policy on www.soinc.org
- Only the wheels, and any part in contact with the floor at the start.
- If a piece falls of the vehicle during the run, it is a Construction Violation

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The Track

- Smooth, level, and hard surface (or whatever they give the Event Supervisor)
- Tape used for Start Point, Target Point
- Measurement Point must start over Start Point
- Target distance between 7 and 10 meters
- Announced after impound period is over
- Minimum of 1.5 meter width
- At least 1 meter beyond target point

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Competition - Impound

- Vehicle and interchangeable parts
- Tools, test date, measuring/calculating devices used to make adjustments need not be impounded
- Power tools requiring an electrical outlet are not allowed
- Laptops may be used, but not impounded, must run on battery.

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Competition – outside help

- Once competitors enter the event area to compete, they must not leave the area or receive outside assistance, materials, or communications until they are finished competing.
  - All assistant coaches and parents should be made aware of this and reminded often.
- Unauthorized , generative AI tools not allowed

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Event Time – 8 minutes

- Can measure distance if desired
- Make up to 2 runs
- May adjust vehicle between runs
  - e.g. Change speed, distance, directional control, changes from impounded parts
- Event Supervisor measurement time does not count in these 8 minutes

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Measurement

- Teams may use their own measuring device to measure track or the distance from the Measurement Point to the line - as part of their 8 minutes
- May not roll the vehicle on or adjacent to the track at any time prior to or during the competition
  - May not roll the vehicle from where it stopped to the finish line to establish correction – may measure though
    - May be a way to preset the braking system

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Sighting/aiming devices

- Sighting and aiming devices may be placed on the track but must be removed before the vehicle begins to run
- Aligning and sighting devices mounted on the vehicle may be removed at team's discretion prior to each run

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It goes down the track

- Competitors must not follow
  - Must wait until called by Event Supervisors
  - 8 minute timing begins again when they pick up the vehicle
  - May do own measurements but it is part of their 8 minutes

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What happens if?

- No movement- students may ask for another try at same run – their 8 minutes – ask the Event Supervisor before touching the vehicle – Not counted as a run
- If a team only gets 1 successful run, that run is the one used to determine the team's score.

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Penalties

- Not impounded – 5000 pts
- Competition Violation – 150 pts.
- Construction Violation – 300 pts.

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Most Common Competition Violations

- Student follows vehicle down track
- Sighting device left on track

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Common Construction Violations

- Vehicle exceeds allowed size
- Parts fall off vehicle during run
- No measurement point

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Failed Run

- Vehicle travels wrong direction
- Start before timers and ES are ready
- Distance cannot be measured
- Team pushes vehicle
- Run out of time for 2nd run

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Scoring

- Run Score = Distance Score + Time Score + Run Penalties (if any)
  - Distance Score = distance from Target point to the Vehicles' Measurement point (the dowel) * 2
  - Time Score = Run Time

Final Score = Better of the 2 Run Scores + Final Score Penalties

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That was the easy part

Now that we've covered the rules, we get into how to build one of these.

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Body / Chassis

- Connects all of the other parts/systems together
- Determines wheelbase
  - longer wheelbase means it is easier to keep vehicle in the lane
- Build as square as possible to go straight. 3d printing can help with this.
- Light but sturdy

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Wide vs Narrow Chassis

Wide chasses tend to go straighter.

Can add more weight.

Adds additional stress to powered axle.

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Wheels and Axles

- Wheels are difficult to make exactly round
- Large diameter Wheel
  - Revolves fewer times to travel a given distance.
  - Vehicle travels faster
  - Heavier
- Optimum size is somewhere in between

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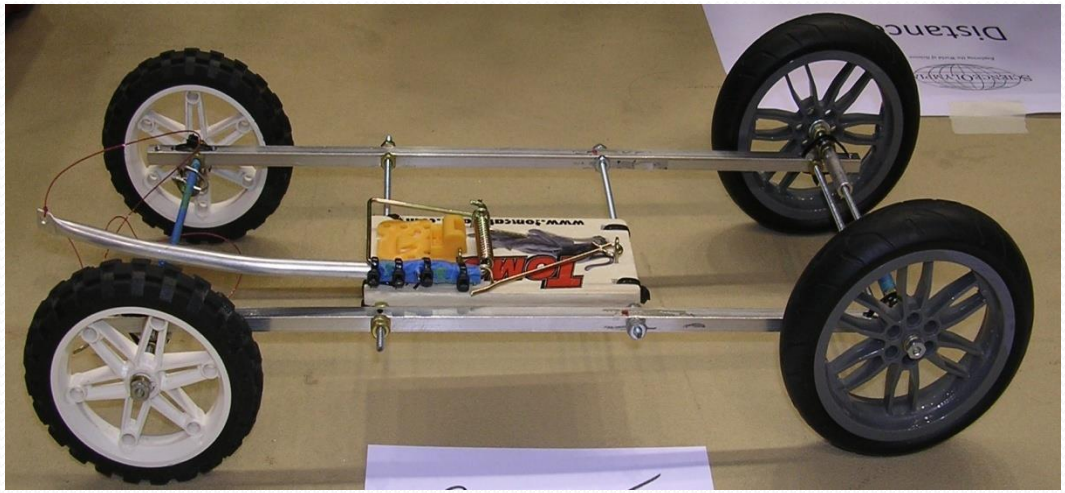
Wheels



Very light chassis, fragile

← Large, heavy wheels add mass and take a lot of energy to turn but have good traction

www.banebots.com
www.pololu.com

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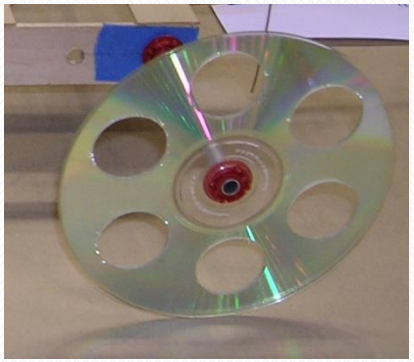
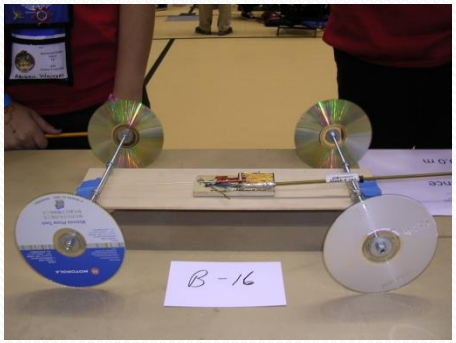
Wheels - Friction

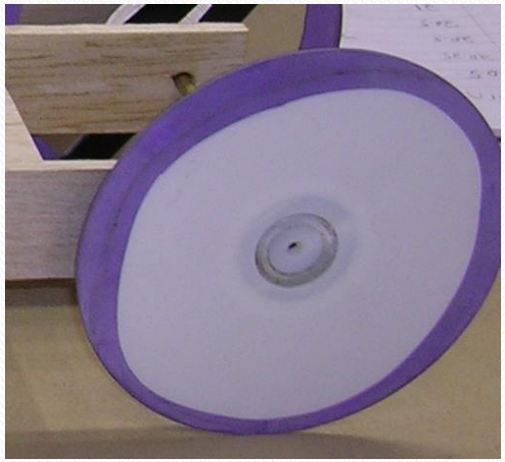


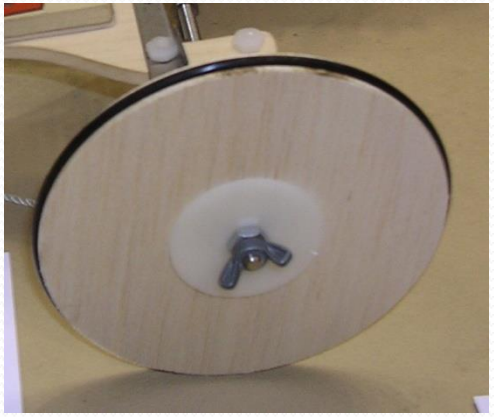


The wheels will tend to spin without grabbing floor unless the friction is increased between the wheel and floor.

Wheels to left are bare and may not give a good start as they might spin.

Wheels to right have something added to increase friction – often a stretched balloon.





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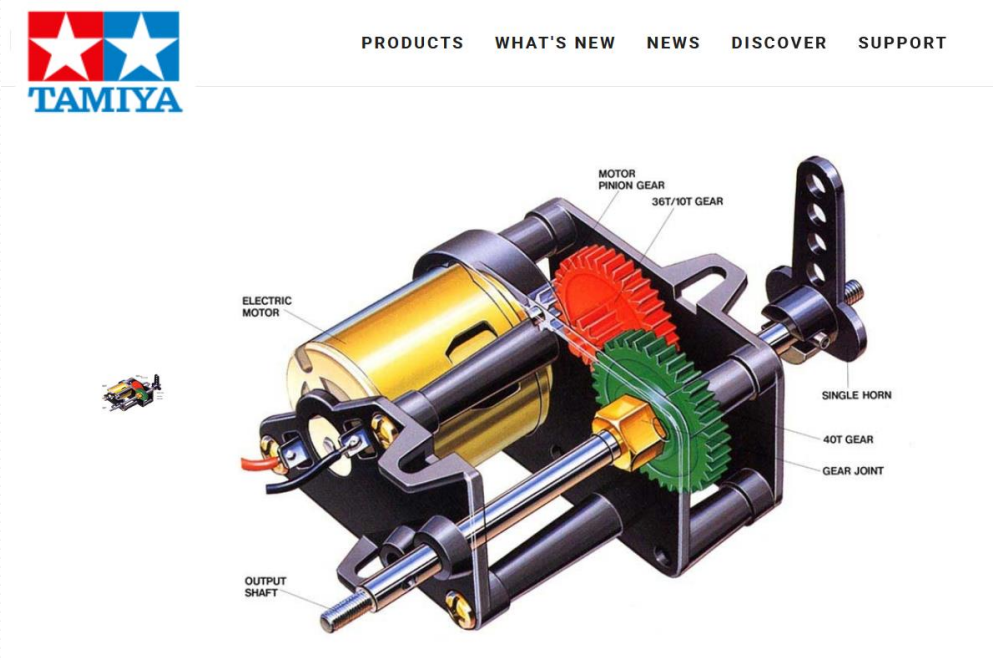
Gearing



https://www.tamiyausa.com/shop/educational-construction/high-speed-gear-box-he/

https://www.tamiyausa.com/shop/educational-construction/sports-tire-set-3/56mm-diaclear-wheels/

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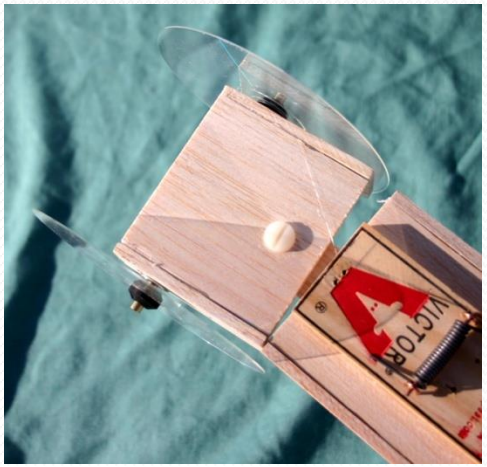
Steering



Difficult to keep properly aimed.

Good way to make small, but lasting changes

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Lengthen out one or two slots on long arm of chassis right beneath axle attachment.

Attach one end of turnbuckle to long arm of chassis and other to axle.

Can make minor but lasting changes to angle of travel.

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Distance Measuring

- Usually implemented by counting turns of wheels.
- May have scale marked on circumference of wheels.
- May apply brake

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Brakes

- None – Coast to a stop
  - Easy to implement
  - Distance unpredictable
- Wing Nut
  - Science Olympiad - Brakes
  - Always stops in the same position.
- Microcontroller
  - Rotary Encoder

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And now, “it’s off and thinking”