

# DE TSA Power Wheels Challenge



# 2017

Edited 12-1-2016

## 1. Car Construction Rules

**1.1. Car Body** Each car shall have a body that consists of a children's ride on toy or a recognizable portion thereof.

**1.2. Drivers** Each car shall be controlled only by one driver seated in or on the car.

**1.3. Car Egress** Each car shall be constructed so that a driver can exit the car unassisted in 5 seconds or less.

**1.4. Car Size** Each car shall be no longer than 62 inches and no wider than 36 inches. Each car, including the driver seated and dressed per the rules, shall not be taller than 72". The driver's seat may not be located lower than the height of the car's highest axle.

**1.5. Wheels and Tires** Each car must have a minimum of three wheels that support the weight of the car. Any wheel driven by a motor shall not be allowed to swivel like a caster wheel. The minimum wheel track (wheel to wheel width) allowed is 12". The minimum wheelbase (axle to axle length) allowed is 18"

**1.6. Steering** No car may be steered by remote control or by anyone beside the driver.

**1.7. Motor Propulsion** Each car shall be propelled by an electric motor. Motors must have a maximum RMS input voltage not greater than 24V.

**1.8. Battery** Each car shall have at least one battery that supplies current to the controller and motor. Each battery in the car shall be SLA: Sealed Lead Acid (maximum 24V may be used).

**1.9. Controller** Each car shall have a throttle controlled motor controller to transfer power from the battery or batteries to the motor(s).

**1.11. Numbering** Each car shall have a unique number somewhere on its body and visible with the driver seated in/on the vehicle. The number shall be assigned by Delaware TSA. The lettering shall be at least 3" tall black lettering on a white background.

**1.13. Required Safety Systems** The following features of your car are required for safety purposes.

**1.13.1. Bumpers** Each car shall have bumper like structures in the front and rear of the car. Each bumper must cover at least 75% of the width of the car. Each bumper must cover at least 1" of height within the vertical space of 46" from the ground. Each bumper shall be covered in rubber, foam, or other impact absorbing material.

**1.13.2. Driver Protection** The car must extend beyond the driver in every direction when viewed from directly above. This protection shall be sufficient to prevent direct contact between the driver and another car/barriers during an impact from any direction. This protection especially applies to feet, which may not dangle off the car. Drivers may not use bumpers as a footrest. In the event of impact, drivers should not be the first point of contact with any outside intrusion of another vehicle or barrier.

**1.13.3. Foot Protection** Each car shall offer forward and side protection for the driver's feet. This protection shall be sufficient to prevent the driver's feet from moving outside the area of the car when viewed from directly above.

**1.13.4. Brakes** Each car shall be able to stop within 18 feet as tested from a full throttle stop. Braking force applied directly to the tire of a car is not allowed to be the only source of mechanical braking. Brakes that apply braking force to the ground are not allowed.

**1.13.5. Battery Retention** Each battery must be secured so that it remains in its position relative to the rest of the car during normal operation and during a tip or rollover.

**1.13.6. Kill Switch** Each car must have a kill switch that stops all current flow from the battery or all batteries to the motor(s). The kill switch must be visible and accessible from the outside of the car. The kill switch should be yellow and/or red in color so someone other than you can shut your kart off in an emergency. The kill switch may not be your throttle. The kill switch should not disable any safety systems.

**1.13.7. Fuse** Each car must have a fuse in series with the battery or batteries such that all current coming from the battery or batteries passes through the fuse before reaching any electrical system. It is recommended that the fuse be located as close to the battery or batteries as possible.

**1.14. Budget** Each car has an allowable budget of \$500. This budget covers only items that are a part of the car as it sits on the grid of the race and does not include the cost of spare parts or development costs. Each component of the car must be totaled in the budget according to the components' Fair Market Value (FMV). Fair Market Value is the cost someone could reasonably expect to pay for that item in similar condition elsewhere without a relationship to the seller/donor. In determining FMV, the retail cost will be used for new parts. All used parts are to be documented as  $\frac{1}{4}$  of FMV retail cost.

**1.14.1. Excluded Items** The following items are excluded from the budget:

- all items whose primary purpose is for a safety system.
- Physical throttle components and linkage
- Original ride on toy price
- Shipping costs for parts/hardware/materials

**1.14.2. Partially Excluded Items** Batteries installed in vehicle (counted at 50% their original FMV)

**1.15. Car Decorations and Modifications** Teams are encouraged to decorate and modify their cars in imaginative ways as long as the decorations and/or modifications do not present a risk of danger or injury to other participants or spectators. Vehicular weaponry is banned. The sanctioning body reserves the right to examine your car and prevent your car from competing if they feel it poses a danger to you, the other competitors, or the spectators for any reason.

## 2. Driver Rules

**2.1. General Driver Rules** Each driver must have a signed release from a parent or guardian.

**2.2. Helmets** Each driver shall wear an approved helmet whenever they are on track to race or practice. Helmets shall be subject to inspection and approval by race officials. An approved helmet shall be a  $\frac{3}{4}$  or full-face motorcycle, motocross, or automotive racing helmet that meets or exceeds

DOT, or SNELL, or ECE standards. Drivers who wear helmets that do not cover the eyes are required to wear DOT approved goggles.

**2.3. Other Attire** Each driver is required to wear closed toe shoes. Members of the pits are to wear safety glasses or goggles.

**2.4 Practice Laps** All Drivers are required to drive multiple practice laps of the course before they drive during a race. These laps are to be made during technical inspection.

### 3. Team Rules

#### 3.1. Team Structure

**3.1.1. Drivers/Pit Crew** Each team must consist of at least 3 members, and no more than 6 members per car. All teams must be members of National TSA.

**3.1.2. Car Entries** Each school may submit any number of car entries.

**3.1.3 Team Sponsorship** Team sponsorships are allowed, and the terms of individual sponsorships are at each team's discretion.

**3.1.4 ACS Donation** There will be no event/contest fee to enter into the contest. Each team is to make a donation to ACS of no less than \$20 per participant on behalf of their school.

### 4. General Event Rules

#### 4.1. Event Structure

**4.1.1. Technical inspection** Technical inspection consists of two laps of the track plus a brake test. Cars that have yet to qualify will line up single file in pit row. Race organizers will call on cars one at a time to perform their qualifying laps and brake test.

**4.1.1.1. Hot Lap** To start inspection, you will take your car on a warmup lap of the track. This warmup lap allows the organizers to verify that your car is working safely. Once you cross the Start/Finish line at the end of the warmup lap, your car's qualifying lap has begun. Provided your car passes the brake test, its qualifying time is the time of its hot lap. If you are not satisfied with your car's qualifying time, you may line up at the end of pit row and attempt to requalify if there is time.

**4.1.1.2. Brake Test** At the end of the hot lap, your car will have to come to a complete stop within 18ft of when it crosses the start/finish line. Deliberately skidding, swerving, or spinning out is not an acceptable method of braking for the brake test. Impacting the barriers is not an acceptable method of braking. If you fail the brake test, you may line up at the end of pit row and attempt to requalify if there is time. Cars that do not pass the brake test are not allowed to race.

**4.1.5. 30 Minute Endurance Race** The race will be an endurance race with a duration of 30 minutes, regardless of lap count. Cars will start this race in their qualifying order. The race ends when all cars cross the Start/Finish line after the race time elapsed has reached 30 minutes.

**4.1.5.1. Driver Changes** During the Endurance race, drivers will have to switch out the driver on each car every 10 minutes. A long horn will sound when it is time for the drivers to switch. Teams must enter pit row as soon as possible after hearing the horn. Cars that have just passed pit lane when the horn sounds will have to complete their current laps before switching drivers. See Section 5 for pit lane safety rules.

## 5. Race Rules

### 5.1. On Track Safety

**5.1.1. Flags** During the course of the race weekend, several flags of varying colors will be displayed. Some will be accompanied by audible horn sounds as well.

**5.1.1.1. Green** The green flag indicates that it is time to race. You will see the green flag at the start of the race, and you may see it once a yellow or red flag condition is cleared.

**5.1.1.2. Yellow** This flag indicates a local or full track caution condition. A full track caution will be accompanied by the sounding of the horn, as indicated below. While the course is under a full track caution, passing is not allowed and drivers should remain in their current order unless instructed otherwise by a course worker. At all corners displaying a yellow flag for a local caution, passing is not allowed and drivers should remain in their current order until past the local caution area, unless instructed otherwise by a course worker.

**5.1.1.3. Red** This flag indicates a temporary pause to the racing due to something rendering part of the track temporarily impassable. While the course is under a red flag, passing is not allowed and drivers should remain in their current order unless instructed otherwise by a course worker.

**5.1.1.4. Black** This flag indicates that your vehicle is to be removed from the track.

**5.1.1.5. White** This flag signifies that the last lap of the race has started.

**5.1.1.6. Checkered** The race is over. Finish your lap, then head back to the pits.

**5.1.2. Horn** The horn has two purposes in a race. Its primary purpose is to sound the beginning and end of a full course caution. One short blast indicates that the course is under a full course caution, and you will see every flag station waving the yellow flags described above. There will be no full throttle racing, there will be no passing. Two short blasts indicate that the full course caution is lifted and you can go back to racing as normal. These two blasts are usually timed right as the current race leader has crossed the start/finish line. The other use for the horn is to signify a mandatory driver change in the endurance race (Rule 4.1.5.1). When you hear this one long horn blast, you must pit immediately even if you have already done so and perform your mandatory driver change.

**5.2. Pit Lane Safety** Cars and participants should not block the pit lane at any time. Reversing in pit row is not allowed during races. Driving the wrong way in pit row is not allowed during races. Cars should be stored with their kill switches off when not being raced or when unoccupied.

### 5.3. Rules Infractions and Penalties

**5.3.1. The Grim Reaper** One person, designated by the Sanctioning Body, will carry a black flag any time cars are on the track. Throughout the race, the Grim Reaper has supreme, unquestionable reign over the track.

**5.3.2. Why am I Upside Down?** It's simple: if you flip your car and roll out of it during qualifying, race or any other point when other cars are on the track, you will get a penalty. The Grim will determine the weight of penalties, including requiring it to be fixed or parked.

**5.3.4. The "Spirit of Power Racing" Clause** We're just a show. We're here to have fun. Rules will get bent, cars will break, so just relax and enjoy yourself. Aside from safety, not much else really matters. You don't race to win – you race 'til you break. Do not become wrapped up or obsessed with awards. Share tools, be friends with rival teams, make friends, and most importantly, be excellent to one another.

### 5.4. Race Awards

- **STEM Integration** – Demonstrated through the integration of STEM as demonstrated in the **Design Portfolio. Mega Highest Award**
- **The Broken Axle Award** – Team that demonstrates the greatest perseverance to complete the challenge while displaying a positive attitude and the spirit of DETSA through sportsmanship. *Highest Award*
- **Dr. John Brown Award** – Team that contributes the greatest amount to the American Cancer Society (ACS). *Highest Award*
- **Smells Like Team Spirit Award** – Team that demonstrates the greatest spirit and craziest outfits as judged by the Grim Reaper. *Highest Award*
- **1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> – 100<sup>th</sup> Place** in Endurance Race – *Highest Award*

## 6. Driver and Team Orientation

**6.4.2. Driver and Team Orientation** This ruleset hereby deputizes the contest coordinator with driver and team orientation prior to each the event. The guidelines for this orientation involves proper driving etiquette and the basic racing guidelines that turns your new team into the one that people will actually like and respect.

## 7. Design Portfolio Elements

- 7.1. Design Concept** Explanation of the overall design concept.
- 7.2. Frame/Chassis/Body** CAD Drawings of the frame, chassis and body with main parts and dimensions labeled.
- 7.3. Drive Train** Explanation and CAD drawings of the power supply drive train and motor controller.
- 7.4. Safety** Explanation and CAD drawings of the safety structures/systems including braking systems.
- 7.5. Budget** Detailed Fair Market Value (FMV) budget for the replication of the project should Mr. Fitzgerald want to make a clone of your vehicle.
- 7.6. Marketing and Promotion Plan** Detailed plan for the promotion and marketing of the project to both obtain sponsors for the car AND to collect proceeds to be donated to the American Cancer Society (ACS).