

# **WISCONSIN** **ELECTRATHON**

*Catch it if you can!*



## **Electrathon Rules**

Effective January 1, 2018



# Contents

|                                    |    |
|------------------------------------|----|
| Competition Classes                | 3  |
| CLASS 1 - STANDARD                 | 3  |
| CLASS 2 - ADVANCED                 | 4  |
| CLASS 3 – OPEN                     | 4  |
| *Exhibition Vehicles               | 5  |
| Vehicle Design Rules               | 5  |
| GENERAL                            | 5  |
| CHASSIS/FRAME                      | 5  |
| CRASH PROTECTION                   | 5  |
| ROLL CAGE                          | 6  |
| HEAD RESTRAINT                     | 6  |
| BODY                               | 7  |
| STABILITY                          | 7  |
| LIGHTING                           | 7  |
| STEERING                           | 7  |
| BRAKES                             | 7  |
| WHEELS & AXLES                     | 8  |
| TIRES                              | 8  |
| BATTERIES                          | 8  |
| ELECTRICAL SYSTEM                  | 9  |
| MOTOR, CONTROLLER, AND DRIVE TRAIN | 9  |
| MIRRORS & VISION                   | 9  |
| SEAT BELTS                         | 10 |
| Driver Related Rules               | 11 |
| SAFETY EQUIPMENT                   | 11 |
| DRIVER                             | 11 |
| BALLAST                            | 11 |
| Safety Inspections                 | 12 |
| Scoring                            | 13 |
| DOCUMENTATION                      | 13 |
| DESIGN & CONSTRUCTION EVALUATION   | 14 |
| BRAKING                            | 14 |
| MANEUVERABILITY                    | 14 |
| ENDURANCE                          | 15 |
| OVERALL WINNER                     | 15 |
| Electrathon Definitions            | 18 |

# Competition Classes

The purpose of the ChallengeUSA Electrathon classes is to allow cars/drivers to compete with their peers. Cars are assigned to classes based on their cost and different design criteria. Teams may request a change in classification by submitting a written proposal to the ChallengeUSA Electrathon Advisory Board. To encourage new construction and designs, no car may compete in Classes 1, 2, or 3 for more than three years. After the third year a car competes, the vehicle's chassis must be retired, although components can be used in future vehicles. During the second and third year a car competes, two of the major systems (frame, electronics, steering, brakes, body, suspension, motor/driveline, and wheels) must be substantially changed from the previous year's competition. These changes will be documented in monthly and final reports.

## **CLASS 1 - STANDARD**

### Design components

- ◆ This vehicle must be a first year car or the car must not have placed in the top half of the season ranking made of all Class 1 vehicles from the previous year's Electrathon competitions. If the vehicle did place in top half of Class 1 season points, the vehicle must move to another class and substantially change two major systems. If vehicle did not place in top half of the ranking, the vehicle may stay in Class 1 but still must change two major systems.
- ◆ The frame and roll bar construction must utilize the type and grade material described in the chassis/frame section of the rules.
- ◆ It is suggested to use a Briggs/Stratton eTek motor ([see motenergy](#)) and an Alltrax (previously Curtis) controller or similar components.

### Cost

- ◆ The vehicle must cost less than \$3,500. A team may have extra parts, such as a chassis, but the total cost of all parts excluding brakes, must not exceed \$3,500. Teams are encouraged to have professionals weld roll cages, suspension parts, and other critical safety items. Cost of safety related welding is excluded from the \$3,500 limit. Rebuilding and modifications are expected and encouraged, as long as the total cost of the parts and labor does not exceed \$3,500. In case of a wreck, the second chassis may be used to rebuild the car, and the car may keep the same number. Two different, complete cars with the same number are not allowed to compete in the same event.

### Drive mechanisms

- ◆ Vehicle must utilize belt or chain drives (no direct or fluid drive mechanisms).
- ◆ No multi-speed transmissions permitted.

### Braking

- ◆ No regenerative braking systems permitted.

### Batteries

- ◆ No solar panel recharging permitted during the challenge; however, it is highly recommended to use solar panels to recharge your batteries BEFORE the competition.

## CLASS 2 - ADVANCED

### Design components

- ◆ This vehicle must be a first year car or the car must not have placed in the top half of the season ranking made of all Class 2 vehicles from the previous year's Electrathon competitions. If the vehicle did place in top half of Class 2 season points. If vehicle did place in top half of a ranking, vehicle must move to Class 3 or build a new vehicle. If vehicle did not place in top half of a ranking, vehicle may stay in Class 2 but still change two major systems.
- ◆ Chassis must have an enclosed body except for driver entry and egress. All frame components, drive line systems, and the driver's body must be enclosed within the body shell. Wheels and tires need not be enclosed.
- ◆ Alternative frame designs must document demonstrated equivalent resisting bending movement to the materials described in the Rules and Regulations.

### Cost

- ◆ Same as Class 1.

### Braking

- ◆ Same as Class 1.

### Batteries

- ◆ Same as Class 1.

## CLASS 3 – OPEN

### Who can compete?

- ◆ Open to teams constructing vehicles that pass the safety inspection, but do not strictly comply with the rules of competition, including the \$3,500 limit on car cost.
- ◆ Colleges
- ◆ Adult and community teams (must have adequate insurance coverage similar to schools)

### Design components

- ◆ Must meet vehicle design rules (Chassis/Frame, Crash Protection, Roll Cage, Head Restraint, Body, Stability, Lighting, Steering, Brakes, Wheels & Axles, Tires, Batteries, Electrical System, Motor, Controller, and Drive Train, Mirrors & Vision, and Seat Belts).

### Cost

- ◆ The cost of the vehicle can be more than the \$3,500 limit set for Class 1 and 2 vehicles.

### Braking

- ◆ Regenerative braking systems permitted.

### Solar

- ◆ A maximum of one square meter of solar cells is allowed on vehicles entered in Class 3. (The one square meter maximum refers to actual cell area and does not include area between the cells.) The cells must be safely attached to the body of the vehicle in such a manner that they do not protrude from the front, sides or rear, endangering others.

### Batteries

- ◆ **In addition to gel cell or AGM**, any type of the following sealed production batteries may be used as long as their weight does not exceed:
  - Nickel-Metal-Hydride 43 lbs.
  - Silver-Zinc 24 lbs.
  - Nickel-Zinc 46 lbs.
  - Nickel-Iron 61 lbs.

Lithium-Ion 16 lbs.

Lithium-Polymer 16 lbs.

Lithium-Iron-Phosphate 30 lbs.

\*Exhibition Vehicles

Vehicles entering as exhibition will not be eligible for any trophies, yet extraordinary performance will be recognized. An exhibition vehicle must meet ALL safety, construction, configuration, and event requirements in order to be eligible to take part in the challenges. Exhibition vehicles are allowed to enter the challenges with components or features that do not meet the requirements of other vehicle classes, including 4 DOT tires. Contact the Wisconsin Electrathon Coordinator with questions.

# Vehicle Design Rules

## GENERAL

1. There is a \$3,500 limit on the value of the material used in the construction of **Class 1** and **Class 2** cars, excluding brakes or professional welding for critical safety items.
2. The \$3,500 limitation is for the parts and materials used in the construction of the car, as it is presented for the competition.
3. This specifically excludes: driver's clothing, driver worn safety equipment, pit tools and spare parts, batteries used for practice, maneuverability, and braking.
4. It does include the batteries used for the endurance competition.
5. Student labor is not charged, but other "volunteer labor" must be included at a reasonable rate.
6. All teams are required to submit a journal documenting the project. Documentation is to include a detailed listing of purchases, donations, and loans of all material used in the construction of the car. Itemization is to include the actual/estimated value and source of the material. Even if other documentation is not submitted, this item must accompany the vehicle in order to compete in the endurance competition.

## CHASSIS/FRAME

1. All vehicles must have frame members and padding that protect the driver in the event of collisions from any direction. The minimum size of such frame members will be 1-inch O.D. round or 1-inch square tubing with the following wall thickness:
  - 0.0625-inch (16-gauge) for mild-steel
  - 0.058-inch for 4130 chrome moly, or
  - 0.083-inch for aluminum
2. For extra support, used in triangulation (see

Crash Protection#5), 3/4- inch O.D. round, or 3/4-inch square tubing may be used as structural members with the following wall thickness:

- 0.0625-inch (16-gauge) for mild-steel
  - 0.058-inch for 4130 chrome moly, or
  - 0.083-inch for aluminum
3. Frames constructed of other materials are allowed on **Class 2** and **Class 3** vehicles providing it is demonstrated and documented that the alternative material(s) or methods provide equal or greater structural strength and protection/safety. It is important to remember that you need to document the calculations and/or testing of alternative frames.
  4. Padding must be installed in the cockpit area to prevent injury from contacting the frame members in the event of an accident. Padding must be at least 1/2-inch thick and made of closed-cell foam.
  5. The vehicle must have a fixed floor pan that prevents the driver's feet and body from contacting the ground.
  6. Driver must not be positioned with his/her head in front of torso, knees, and legs. This rule is designed to minimize injury in case of a crash.

## CRASH PROTECTION

1. Each vehicle shall have structural members at the front of the vehicle that act as a barrier/bumper to protect the feet of the driver and to help prevent intrusion into another vehicle in the event of a crash. The dimensions of these structural members shall be eight inches vertically and eight inches horizontally (a square/circle/oval that will not fit through the 6 inch space in Crash Protection #5). **If the dimensions of these structural members are smaller than the allowed 8 inches horizontally**

or vertically, the material must be collapsible so as to not intrude into another vehicle in the event of a crash. Teams must be able to demonstrate that the material is collapsible during the inspection process.

2. The barrier must be made of materials that meet the minimum standards for frame components.
3. Aerodynamic fairings may be used in front of the barrier/bumper frame members to enhance airflow. Fairings must be able to collapse in event of a collision with another vehicle (see #4 body)
4. Frame members on the side of the vehicles shall be designed to help ensure that another vehicle cannot intrude into the driver's compartment in the event of a crash.
5. No spacing larger than 6 inches is allowed on the frame of the body of the car (front & sides) around the driver's compartment and battery box(es) as tested with a 6-inch diameter disc. The advisor will be responsible for this testing during construction, and will sign off on safety inspections that the vehicle passed the test.
6. Side impact protection must extend up to top of driver's shoulder.
7. Frames not meeting the requirements stated above are allowed if it is demonstrated and documented that the alternative material(s) or methods provide equal or greater structural strength and protection/safety.

## **ROLL CAGE**

1. Roll bar shall consist of at least one bar going from one frame rail, over the driver's head, and connecting to the other frame rail. This bar shall be braced fore and aft as specified below (see #4)
2. The roll cage must extend high enough to provide a 2-inch space cushion (measured from the bar, not the padding) above the helmet of the tallest driver.
3. The center of the driver's helmet must be

centered inside and completely contained within the roll cage.

4. The roll cage must be braced to the chassis, forward and rearward. The rearward brace will be no more than six inches vertically from the top of the roll bar. The forward bracing shall form a protective cage around the driver and be designed to protect the driver from front and side impact injury.
- 4a. Frontal protection is determined by drawing a straight line touching the framework horizontally across the area in front of the driver's face. This straight line should be a minimum of 2 inches from the driver's face.
5. The cage must be made of tubing that meets the minimum standards for frame components. Roll bars constructed of other materials may be allowed if it can be demonstrated that the alternative material(s) provide equal or greater structural strength and protection/safety.
6. An inspection hole, at least 1/8-inch in diameter must be drilled in a non-critical area of the roll bar to permit inspector confirmation of the wall thickness.
7. Padding must be installed to prevent the driver from being injured by contacting the roll bar **from the waist up** in the event of an accident. Padding must be at least 1/2-inch thick and made from closed-cell foam.
8. All parts of the driver shall be completely inside of the frame cage at all times when in the normal driving position (this includes hands on steering bar).
9. The strength of the roll cage must be able to withstand 350 lbs of pressure, which may be tested at events. A 350-pound static load may be applied to a 2-inch linear section of the roll bar. The frame will be placed on blocks, so wheels will be off the ground when tested. Roll bars may not deflect more than 1 inch.

## **HEAD RESTRAINT**

1. A head restraint, capable of withstanding a force of 100 pounds or greater in the rearward

direction, is required to prevent whiplash. Padding must be installed to prevent the driver from being injured from contacting the head restraint structural elements in the event of an accident.

## **BODY**

1. The maximum length of a Wisconsin Electrathon vehicle is 12 feet. The maximum width is 4 feet (measured at the widest point of the entire vehicle, with body attached). Minimum track width is 24".
2. The body must not have sharp edges, corners, or other protrusions that could injure the car's driver, other drivers, track officials, or spectators.
4. Any part of the vehicle in front of the 8" x 8" bumper needs to be easily collapsible or not be able to enter between the 6" chassis/frame spacing.
3. All teams will choose vehicle identifications (VID) and will check with the Wisconsin Electrathon Coordinator to make sure the VID is not already taken by another team. All VID's will include a two-digit number followed by the two letter state abbreviation. An S (Standard), A (Advanced), or O (Open) will signify competition class and will precede the numbers (example: S 06 WI). Once a VID is issued, it will normally be retained in subsequent competitions.
4. The VID must be easily read from both sides of the car. The VID should be displayed in an area approximately 20" wide by 8" high. The car should have rigid or semi-rigid surfaces large enough to mount a VID on each side.
5. Track officials will have to push a car clear of the track in the event the car is disabled. It is recommended that a "push here" sign be added at the proper points on the vehicle. Damage to the body structure may occur during the competition if these markings are not present.
6. Enclosed canopies will not be taped-on or fastened in a manner that could hamper

emergency egress. Canopy must be easily removable by driver or track officials.

## **STABILITY**

1. All vehicles must demonstrate inherent stability at rest, while cornering, braking, and cruising at top speed.

## **LIGHTING**

1. All vehicles must be equipped with a clearly visible brake light that is activated automatically whenever the brakes are applied.
2. The brake light should be easily seen by a following vehicle and have a minimum visible area of 4 in x 2 in.

## **STEERING**

1. Steering arms, rod ends, ball joints and all associated hardware serving to mount any steering elements must be equivalent or greater in strength than 3/8-inch diameter steel rod. Kingpins must be made of material that is as strong or stronger than a 3/8-inch solid steel rod.
2. No single tie rod or single hand push pull steering designs are allowed.
3. Each vehicle must have a steering geometry capable of a 40-foot maximum turning diameter in both directions. Steering capabilities will be inspected on the outside edge of the vehicle, not the centerline.
4. Locking nuts or jamb nuts are required on all steering components.

## **BRAKES**

1. All vehicles must have mechanical or hydraulic brakes. Vehicles must have brakes on at least two wheels that are on the same axle (either both front or both rear wheels).
  - 1a. Hand operated brakes must allow full

application without taking the driver's hands off the steering devices(s).

1b.Brakes that use a ground contacting mechanism are not allowed because of the possibility of adversely affecting the stability of the vehicle.

2. Effective braking will be checked before the endurance phase of the competition. A "push test" will be conducted on all vehicles immediately before the start of each endurance competition. Brakes may also be checked at the end of the competition, at the discretion of track officials.

3. Brakes must be able to stop the vehicle in a straight line within 25ft.

4. Regenerative braking is permitted in addition to conventional brakes on vehicles competing in Class 3.

5. The brakes must be capable of holding the vehicle stationary while being pushed by one person.

6. See the **Braking** section under **Scoring** for more details.

## WHEELS & AXLES

1. Vehicles must have a minimum of three load-bearing wheels in contact with the ground at all times.

2. The wheels and axles must be strong enough to withstand the test for braking, maneuvering, and endurance competitions.

3. Wheels must be covered if they could endanger the driver.

4. Axles must be a minimum diameter of 12mm or 1/2-inch unless supported at both ends. Safety wire, double nutting, or cotter pins must be used to secure cantilevered wheel axle nuts. Nylon lock nuts alone are not acceptable.

## TIRES

1. Tires must be pneumatic (inflatable).

2. With driver in the car the vehicle ground clearance must exceed the sidewall height of

the tire to keep the vehicle off the ground in the event of a flat tire.

3. While in driving position the driver's body must not be able to come in contact with tires, wheels, or spokes.

## BATTERIES

1. Except for communications devices, no accessory batteries are permitted in any class.

2. In Classes 1 and 2, vehicles are limited to a maximum of 73 pounds of batteries, including any batteries used for motor controllers, contacts, relays, solenoids, instrumentation, computers, etc.

3. Batteries used for two-way communications devices are not included in total battery weight.

4. Batteries of vehicles are weighed at the beginning of each competition season and whenever new batteries are introduced to a vehicle. In addition, batteries are subject to being weighed randomly - or at the discretion of track officials at any time.

5. Batteries must be "commercially available", and may not be physically modified to increase their performance or lighten the case.

6. In Classes 1 and 2, batteries must be gel cell or AGM (absorbed glass mat) with total weight not to exceed 73??? pounds. Teams must provide manufacturers information on battery construction at inspection.

7. The battery box must be securely fastened to the frame and the batteries held firmly in place within the box by such means that they will remain in place in the event of a vehicle roll over or impact.

7a. Drive batteries must be enclosed in a box or other structure that will protect the batteries from puncture as described in **Crash Protection** – item #5. The design of the battery box shall be non-conductive, or if made with conductive materials, shall assure that the battery terminals cannot contact the conductive material.

8. Batteries may not be remotely recharged or

replaced once the endurance competition has begun.

9. A different set of batteries can be used for braking and maneuverability than for the endurance competition of equal weight and type.

10. A WE official will pre-certify competition batteries prior to the competitions. If you have any questions about a battery, send your question to

[Electrathon@challengewisconsin.org](mailto:Electrathon@challengewisconsin.org). If a battery, which has been pre-certified, is replaced during the season, it will have to be re-certified.

11. Tools used around batteries should be non-conductive or wrapped in electrical tape to prevent accidental electrical shorts.

### **ELECTRICAL SYSTEM**

1. All vehicles must have fusing or a circuit breaker between the battery and motor controller. It is also recommended but not required to put a fuse between the motor and controller to protect the controller from a short in the motor.

2. The master disconnect switch, or pull cord for the master disconnect switch, must be easily accessible by both the driver and by officials from both sides of vehicle during the competition. It must be mounted at or above the driver's shoulder and clearly marked with an equilateral triangle with four inch sides in a highly visible color that contrasts with the body color.

2a. The switch must be located in the main power cable between the battery and any motor controller and must include an on and off label.

3. The driver's disconnect switch shall be mounted in the drivers field of vision, where he/she can operate it from driving position. The driver's switch can be a separate device or the same device for track officials.

4. Any master disconnect, contactor, or circuit breaker must be DC rated. The recommended

minimum cable size is #6. When continuity is interrupted, the contacts will draw an arc between them. This arc needs to be extinguished to prevent welding of the contacts together. DC arcs are more difficult to extinguish than AC arcs, therefore a device with an AC rating would typically be rated much lower as a DC device.

5. Motor power must be designed so that the motor(s) turn off automatically if the driver releases the throttle.

6. Each circuit must include an appropriate sized fuse or circuit breaker. Wiring must be of suitable size (using the National Electric Code Ampacity Charts as a guide) so that the fuse or breaker will blow before the cable insulation can melt. Wiring should be neat, well insulated, and securely tied to the frame. All wiring must be kept clear of moving parts and protected from chafing. The vehicle frame may not be used as a conductor for any part of the electrical system. Electrical drive system must be isolated from the chassis.

### **MOTOR, CONTROLLER, AND DRIVE TRAIN**

1. Cars can only be powered by electric motors.

2. Any type of power (speed) controller is allowed.

3. Remote control of a vehicle is not permitted.

4. All chains, gears, etc. must be guarded/covered when power switch is on to minimize exposure of anyone who may come into contact with vehicle "pinch-points" at the pulley/sprocket. The guard/cover shall also serve as damage and injury protection for slipped or broken belts/chains. It is highly recommended the vehicle be rendered inoperable whenever the guard/cover is removed for access to the chain/belt.

### **MIRRORS & VISION**

1. All vehicles must have at least one

functional rearview mirror - with a total mirror area of no less than eight square inches. The mirror arms must be solid, and in useable condition throughout the competition. The mirror(s) must provide a 120-degree field of vision to the rear. Field should extend 60 degrees on each side of centerline from the rear of the vehicle. Documentation should show testing and verification. Team members may be asked to demonstrate effectiveness or answer questions on testing.

2. The driver must have at least 180 degrees of unobstructed vision of the track, not including vision of the track seen through mirrors. Vision obstructed by frame members is accepted.

3. Canopies, if used in competition, must be in

place for all vision tests.

### **SEAT BELTS**

1. All vehicles must be equipped, at a minimum, with a five-point lap and shoulder strap seat belt. The harness/lap belt strapping is to be at least two inches in width and the harness set must be commercially available and installed in the vehicle in accordance with manufacturer's instructions. Installation compliance should be included in the vehicle documentation.

2. The harness shall be equipped with a quick release that is easily accessible to the driver and track personnel to allow easy exit from the vehicle.

# Driver Related Rules

## SAFETY EQUIPMENT

1. All drivers must wear well fitting, DOT approved full-face motor vehicle or motorcycle helmets with a Snell rating of 95 or greater (to be certified by the advisor prior to the challenge). The helmets must be clearly labeled as meeting the Snell rating. Bicycle helmets are not acceptable. Helmets must be worn with the chinstraps correctly fastened.
2. All drivers must wear eye protection (Z87 safety glasses with side shields or goggles). Face shields on helmets are sufficient. All team members must wear safety glasses in the pit area or near competing vehicles.
3. All drivers must wear fully soled, over the ankle, standard, commercially available footwear that protects the feet. The minimum standard is a fully soled, over the ankle, good quality cross training tennis shoe or fully soled, over the ankle, all leather, wrestling shoe.
4. Drivers must be fully clothed with heavy clothing, i.e., long sleeve shirt, pants, and gloves. Fingerless gloves are allowed.
5. All moving parts that could endanger the driver, crew, and track personnel must be shielded.
6. No rings, wristwatches, bracelets, long necklaces or unrestrained long hair in pit area or near competing vehicles. Long hair must be pulled back and controlled.
7. Each team must have at least a ten-pound dry chemical extinguisher present where the vehicle is competing during any event and in the pit area.
8. All safety equipment must be in place and fastened before the driver leaves the pit during the endurance competition. Teams are subject to one-lap penalties for each non-compliance.
9. Speedometers are encouraged so students can monitor their speeds.

## DRIVER

1. Drivers must complete the necessary driver forms and wear appropriate wristband or other driver identifier item received upon driver approval at each event.
2. All drivers must sign a liability waiver prior to any competition. Drivers under 18 must have a parent or legal guardian co-sign the liability release.
3. For all phases of the competition, the vehicle operator is to weigh at least 150 pounds.
4. Drivers weighing less than 150 pounds must carry enough non-liquid ballast to make up that difference (see **Ballast** below). All personal protective equipment, including helmet, clothing, and glasses are considered part of the driver and count toward the 150-pound minimum.
5. Drivers must be able to exit the vehicle and remove canopy unassisted in 20 seconds or less.
6. Graduated seniors may compete in the season's fall competitions, depending on their local school's policy.
7. Drivers and cars may be impounded for post-competition inspections.

## BALLAST

1. Driver and ballast will be weighed prior to each competition. They may also be weighed after competition.
2. Ballast must be removable for weigh-in, but securely attached (belted, strapped, or secured by fasteners) during competition.
3. Each driver is responsible for providing the correct amount of ballast to meet weight requirements at the end of the competition.
4. Ballast must be a solid, non-structural component. The use of weightlifting weights or

solid bars is recommended. Each individual piece must weigh a minimum of one pound. No sand bags or wheel weights allowed. Preapproval of any ballast item other than weights or solid bars is recommended.

# Safety Inspections

1. The purpose of the inspection phase of the competition is to judge the safety (construction, braking, and stability) of the vehicle prior to the endurance phase of the competition. Each vehicle will be inspected and must pass braking and maneuverability (steering radius) before it is allowed to participate in the endurance phase of the competition. Each team should furnish a "Student Car Captain" to accompany the car through the inspection process to answer questions about the vehicle and its construction.

2. All vehicles that have been subsequently modified must be presented for re-inspection prior to participating in any endurance rally.

3. Vehicles that do not conform to Wisconsin Electrathon regulations or that have failed to pass all of the inspection phases of the competition will not be allowed to compete for points. Units that do not comply with the safety related regulations will not participate in the

track events.

4. Drivers who cannot demonstrate compliance with Wisconsin Electrathon regulations will not be allowed to participate. Drivers must have driver's wristband on them at time of inspection

5. Advisory inspections may be arranged prior to the day of the competition - if desired. This is advisable for first-time participants or if vehicle modifications are made between competitions so those unexpected items of noncompliance do not force the vehicle out of competition. These pre-competition advisory inspections do not replace competition day inspections. Awards for braking and maneuverability will not be given to participants who cannot pass inspections during scheduled times.

6. The top three placing vehicles in each class may be inspected after the endurance competition. Weight of the driver and ballast will be checked as well as vehicle batteries.

# Scoring

An award may be given to a winner in each category at each event.

The categories are:

1. Documentation/Journals (1<sup>st</sup> place)
2. Design (1<sup>st</sup>-3<sup>rd</sup> places, overall)
3. Braking (1<sup>st</sup>-3<sup>rd</sup> places, overall)
4. Maneuverability (1<sup>st</sup>-3<sup>rd</sup> places, overall)
5. Endurance (1<sup>st</sup>-3<sup>rd</sup> places each class)
6. Overall event champion (1<sup>st</sup> place for event)
7. Overall season champion

Points are awarded for the design competition as shown below:

| Place           | Points | Place            | Points |
|-----------------|--------|------------------|--------|
| 1 <sup>st</sup> | 50     | 6 <sup>th</sup>  | 35     |
| 2 <sup>nd</sup> | 47     | 7 <sup>th</sup>  | 32     |
| 3 <sup>rd</sup> | 44     | 8 <sup>th</sup>  | 29     |
| 4 <sup>th</sup> | 41     | 9 <sup>th</sup>  | 26     |
| 5 <sup>th</sup> | 38     | 10 <sup>th</sup> | 23     |

Point values will continue to decrease by 3???

Points are awarded for braking and maneuverability (slalom) as shown below (for each event):

| Place           | Points | Place            | Points |
|-----------------|--------|------------------|--------|
| 1 <sup>st</sup> | 75     | 6 <sup>th</sup>  | 67.5   |
| 2 <sup>nd</sup> | 73.5   | 7 <sup>th</sup>  | 66     |
| 3 <sup>rd</sup> | 72     | 8 <sup>th</sup>  | 64.5   |
| 4 <sup>th</sup> | 70.5   | 9 <sup>th</sup>  | 63     |
| 5 <sup>th</sup> | 69     | 10 <sup>th</sup> | 61.5   |

Point values will continue to decrease by 1.5.

Points are awarded for the endurance competition as follows (for each event):

| Place           | Points | Place           | Points |
|-----------------|--------|-----------------|--------|
| 1 <sup>st</sup> | 200    | 6 <sup>th</sup> | 177.5  |

|                 |       |                  |       |
|-----------------|-------|------------------|-------|
| 2 <sup>nd</sup> | 195.5 | 7 <sup>th</sup>  | 173   |
| 3 <sup>rd</sup> | 191   | 8 <sup>th</sup>  | 168.5 |
| 4 <sup>th</sup> | 186.5 | 9 <sup>th</sup>  | 164   |
| 5 <sup>th</sup> | 182   | 10 <sup>th</sup> | 159.5 |

Point values will continue to decrease by 4.5.

## DOCUMENTATION

1. The documentation portion of the competition is worth 275 possible points.
2. Each team will submit 3 progress reports on the project. These reports are worth 25 points each and should describe the overall progression and accomplishments to date. They should include a cover letter and not more than one page per car, not including photos, which may also be attached. The first report is due on the last day of January. The subsequent reports are due on the last day of February and March. Send reports electronically to [Electrathon@challengewisconsin.org](mailto:Electrathon@challengewisconsin.org) as an attachment. The reports and the team scores will be posted on the Wisconsin Electrathon website.
3. Each vehicle (team) is also required to create a journal of the entire project, which will be worth 200 points. Final reports must contain the minimum safety requirements highlighted on the rubric (see website for rubric). If no final report is submitted, vehicles are not eligible for placement. Particular attention is to be given to recording the vehicle's design and construction. This material is to be emailed to [Electrathon@challengewisconsin.org](mailto:Electrathon@challengewisconsin.org) no later than May 1 unless stated. Retain a copy of the journal for your own use during the inspection periods. The journal should be kept up-to-date at all times and contain:
  - Discussion notes
  - Calculations, photos, drawings, test results
  - Correspondence

- School & general publicity and news stories
- Information about fundraising efforts (events, activities, donor names, etc.)
- Community support
- Student, faculty, and community involvement
- Anything that would help describe the efforts involved in building the vehicle
- Additional documentation such as posters, computer data, video/audio tapes, and CD's may also be included.

4. Judging will be based on completeness of content, journalistic quality, effort, and neatness (see scoring forms on website).

### DESIGN & CONSTRUCTION EVALUATION

Vehicles will be judged at each event using varied methods from instructors to peers. Best Design trophies will be awarded. Judging should be evaluated using the following criteria:

- Quality and durability of construction
- Engineering design principles utilized
- Effective use of materials
- Overall roadworthiness of the vehicle
- Creativity in design and construction

### BRAKING

There are two portions of the braking competition:

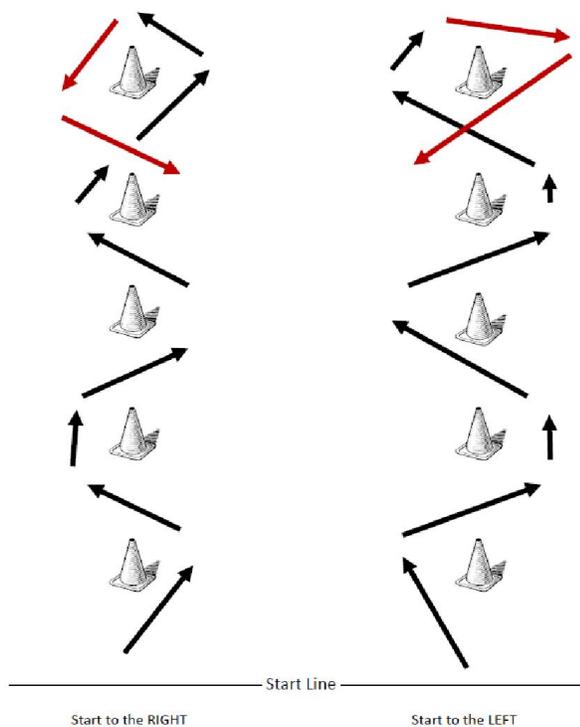
1. All vehicles will be tested on braking efficiency from cruising speed. From a running start (**minimum 15 M.P.H.**), the vehicle must stop in 25 ft. or less and be kept under control and within certain boundaries during the stop. Uncontrolled stops will not count as legitimate attempts. **The vehicle must be travelling at 15 M.P.H. at the “braking line”**. Each vehicle will be allowed two runs, with the better of the two being used to determine the score. Vehicles will be ranked and awarded points accordingly.

2. The brakes must be capable of holding the vehicle stationary when being pushed by one person.

### MANEUVERABILITY

1. Each vehicle must have a steering geometry capable of a 40-foot maximum turning diameter in both directions. Steering capabilities will be inspected on the outside edge of the vehicle, not the centerline.

2. A slalom course consisting of five (5) cones, spaced 25 feet apart will be run out and back, by each vehicle from a standing start. **The starting line will be 25 feet before the first cone.** Each vehicle will be allowed to make three runs, with the first run a practice run. In order to pass inspection, a vehicle must be able to complete the course with a maximum time of 35 seconds. The average time of the **two official** runs will be used to determine the score. If the vehicle only attempts one run, the second run time will be the highest run time of all participating vehicles that day. The vehicle will start from **the opposite side of the cones for the second qualifying run as it did for the first qualifying run.** This will confirm that the vehicle has adequate steering.



Vehicles will be ranked and awarded points accordingly. Five (5) penalty seconds will be assessed for each cone struck. Ten (10) penalty seconds will be assessed for each cone knocked over. Five (5) penalty seconds will be assessed for each time a wheel leaves the ground. Ten (10) penalty seconds will be assessed if a cone is missed. If more than one cone is missed, the run is terminated (no longer timed) but still counts as one of the three attempts. A rollover will require the vehicle to undergo a new qualification inspection and may result in disqualification from that day's competition. Teams are strongly encouraged to practice this maneuver prior to competition so that the vehicle's stability characteristics are known.

## ENDURANCE

2. During endurance rallies vehicles will be required to run on a track for a period of exactly one hour. At the end of one hour, the total number of completed laps will be counted.

The time of the last completed lap will be used to break ties. In the event that multiple vehicles record the same number of laps, the vehicle that completed the last lap with the most amount of time remaining will be scored highest. Each event will include at least two heats. Only the number of laps completed in the best heat will be counted for points. The winner of this phase of the competition will be the vehicle that has completed the most laps in either heat.

3. Track officials will clear from the track any vehicles experiencing a breakdown or loss of power. That portion of the lap will not count toward the team's total. If the car returns to the track, it must do so from the pit area and will begin from the last complete lap total.

4. A vehicle that enters the pit area under its own power will be considered to have completed a lap. If the vehicle does not enter the pits under its own power, the last lap is not considered complete.

5. At a point between 20 and 40 minutes (if required in the competition) the vehicle must stop for a required pit stop. A pit stop is considered valid if the vehicle enters and leaves the pit area under its own power (no assistance in stopping and/or starting of the vehicle by pit crew). See exceptions below. During the pit stop, a driver change in the designated area may be mandatory and every vehicle must be in the pit and stopped for no less than 1 minute. If you have a one-driver team, the driver must get out, walk around the car, and get back in the vehicle. The vehicle would spend any remaining time at a stand-still in the pit. Repairs and adjustments can be made to the vehicle during the driver change pit stop. If you are black flagged to pit for a repair, you still must make a separate driver change pit stop. Exceptions: If you are hauled in *before* the 20-40 minute pit stop begins, and are in the pits during the allotted time, or if you are hauled in *during* the 20-40 minute pit stop, the last lap will not be counted as complete, but the time you spend in the pit area will count toward the

mandatory pit stop. If you miss the mandatory pit stop completely, you will be disqualified.

6. The top three placing vehicles in the endurance competition may be inspected after the endurance competition. Weight of the driver, ballast, and batteries will be checked

### **OVERALL WINNER**

1. There will be an overall winner at each event. Points will be combined from design, braking, and maneuverability competitions and the endurance competitions.

2. There will be an overall season winner with 1075 total competition points available. The overall season winner will be the team (vehicle) that accumulates the most points from combining Documentation points and the best 2 events that the vehicle attends.

4. Non-Wisconsin teams are eligible in all classifications for both event and overall season award.

### **TIE BREAKERS**

1. Maneuverability
  - a. Fastest first attempt
  - b. Highest endurance lap count
2. Braking
  - a. Shortest first attempt
  - b. Highest endurance lap count
3. Endurance
  - a. Earliest time stamp on last completed lap.
4. Design
  - a. Pull name out of a hat.
5. Event Champion
  - a. Highest endurance lap count
6. Season Champion
  - a. Highest documentation score

## Electrathon Definitions

### Commercially Available

Available to be purchased or traded for; not manufactured by a team.

### Enclosed canopies

A covering over the frame cage/cockpit (i.e. driver) used as a windscreen or to aid in aerodynamics.

### Frame cage/cockpit

The area which the driver occupies. It could include the areas where the motor and batteries are housed.

### Frame members

The parts of the car frame that provide its primary strength. They include the parts of the car that support the axles, seat, motor, roll cage, frame cage/cockpit, and batteries.

### Ground contacting mechanism

Anything that contacts the road surface to assist with turning, slowing, or stopping the car.

### Head restraint

A padded support behind the driver's head to prevent whiplash in case of a collision and to support the head while driving.

### Nylon lock nuts



### Roll cage

An enclosure designed to protect the driver's head and body. It is made of three main components: the roll bar, forward bracing and rear bracing. These components must be made of frame member materials.

### Roll bar

At least one framing member that goes above the driver's head. It must be supported or reinforced with the forward bracing and rear bracing.

### Single tie rod

One tie rod that is connected between the two tires and used for steering.

### Structural members

The pieces of the car frame that provide secondary support and shape to the car frame. They include guards, barriers, and bumpers.