

# *Official Rules:*

## FIFTH ANNUAL MISSOURI SUPERMILEAGE VEHICLE COMPETITION

### ***April 20, 2010 - Warrensburg, MO***

The objective of the competition is to provide students with a challenging project that allows practical experience in design, fabrication, and testing. This is exactly what the STANDARDS FOR TECHNOLOGICAL LITERACY from the International Technology Education Association are all about!

In an effort to increase support and promote Technology Education; public awareness in the area of fuel economy and student involvement, a fuel economy competition will be held. Competing students will be challenged to build a one person, fuel efficient vehicle powered by a single cylinder four stroke cycle engine. The vehicles will run a specified course at a certain speed.

This competition is open to all middle school and high school students from Missouri's public and private schools.

### **I. VEHICLE SPECIFICATIONS:**

#### ***A. General Configuration***

1. The vehicle must have a minimum of three wheels touching the ground at all times.
2. Vehicle length, width, and height will not be regulated.
3. Provide a location on both sides for car numbers. (8 ½ x 11)
4. Body roll cage must protect driver. (2" above helmet of all drivers) \* Detailed in section II
5. NO head first vehicles will be allowed.

#### ***B. Maneuverability***

1. Each vehicle must have a steering geometry capable of 35 feet minimum inside turning radius. Meaning, it must be able to make a U-turn within a distance of 35 feet.

#### ***C. Stability***

1. Each vehicle will be required to demonstrate its longitudinal stability. The vehicle, with the qualified driver, must maintain full wheel contact on a ramp of 15 degree (measured from horizontal) while located statically on the ramp to the following configuration:
  - a. One front wheel and one rear wheel of the vehicle must contact a horizontal line (running the length of the ramp) on the ramp with the vehicle in full right and left turn positions. No supporting structure or wheel may contact the ramp below the horizontal line.
  - b. The steering wheel/wheels are to be turned lock to lock on the 15° angle and the vehicle must demonstrate NO tipping.
  - c. This test will be performed without help from the pit crew to stabilize.

#### ***D. Engine***

1. All vehicles may use any brand 4-cycle engine that has a recoil start, runs on regular unleaded gasoline, and is factory rated out of the box, 6 hp or less. This would include but not limited to brand names such as Honda, Briggs and Stratton, Tecumseh, or Kohler. Also included would be 4-cycle engine sizes ranging from micro and 2.4, all the way up to 6 hp.

2. Engine Classifications:
  - a. **Stock.** The engine used on a stock vehicle must be box stock! This means no electric start flywheel changes, no air filter removal (including the canister) or changes, and no changes in exhaust (the stock muffler must remain in place) Detailed in section II G. However, judges will allow the lengthening of the recoil rope to suit engine and driver positions.
3. The competition committee has ruled that there will now be an Experimental Class!
  - a. **Experimental.** In the experimental class a school may use any engine that burns any fossil fuel, ethanol, ethanol & fossil fuel blend, and any drive system they desire. All the same safety rules will apply. If the engine burns anything other than regular gasoline, the team must provide proven calculations for mileage to the Missouri Supermileage coordinator and event officials. (This would refer to the fuel density specs.) Experimental engines will receive extra scrutiny and attention during vehicle inspection and any engine or drive system that has any doubt of being safe by the inspection officials will be disqualified.
4. Judges reserve the right to call a questionable vehicle to the Officials Building to re-inspect and determine if said vehicle violates competition rules. If a vehicle is in violation of competition rules it will be eliminated from competition and any completed runs will be forfeited. Judges reserve the right to tear an engine down and inspect it!

#### ***E. Additional On-Board Equipment***

1. Batteries can be carried in each vehicle, and in no way can they be used to propel the vehicle. They must in no way be capable of powering the vehicle. The sole source of vehicle propulsion must be from the engine. This means no human power system, sails, etc. Any inertial system, if used, must be at rest prior to the start of any performance runs. Any vehicle found in violation of this rule will be eliminated from competition and any completed runs will be forfeited.

#### ***F. Fuel***

1. The fuel used will be gas-ethanol blend (10% Blend) to provide uniformity in the composition. It will be purchased on the first day of competition, for best results.

#### ***G. Driver Weight***

1. Minimum driver weight is 130 pounds, fully equipped, including helmet.
2. Drivers who do not meet the minimum weight requirement must provide ballast to bring their weight up to the 130 pound base limit.
  - a. Ballast must be securely attached to the vehicle.

#### ***H. Electric Start Restrictions***

1. The electric starter cannot be used to propel the vehicle forward in anyway. (from a stopped position or while coasting).
2. Any vehicle found using an electric starter for forward propulsion will be eliminated from further competition and all previous successful runs will be forfeited. No exceptions.
3. Vehicles with electric start and using a centrifugal clutch must demonstrate that the clutch is not locked and will turn freely of the electric start!
4. Vehicles with electric start and using a belt drive system must have an electric start off switch connected to the belt drive system. Drivers must demonstrate to judges when the belt drive system is engaged, the electric start is switched off and cannot be engaged in any way!
5. Stock engines may run electric starters, **BUT THE ENGINE MUST NOT BE CHANGED IN ANY WAY**, Example—Starters are allowed on the out put shaft or drive train parts.

## **II. REQUIRED SAFETY ITEMS:**

The following are the minimum safety items required of all vehicles. Failure to comply with these specifications will result in disqualification until such infractions are corrected.

### **A. *Kill Switch***

1. Two kill switches grounding the engine ignition are required. One must be mounted in easy reach of the driver, and one must be accessible from outside the vehicle (for pit crew), and the existing switch in the shroud of the engine (STOCK ONLY) must be used as a third switch.
  - a. The exterior kill switch must be marked with a bright colored marking, the switch plate no less than 2" square.
  - b. All kill switches must be a toggle type with a minimum of a ½" paddle.

### **B. *Guards and Shields***

1. All moving power train components must be guarded from accidental breakage or body contact by driver or pit crew member. If the wheels are inside of the body shell, then they must be shielded to prevent propulsion by the driver. The driver must be shielded from the ground.
2. The side body of the car must enclose and cover driver above the elbows from driver's back to driver's feet when the driver is seated in the normal driving position.
3. Body ROLL cages are required. They must be substantial and remain 2" above all drivers' helmets, and over the helmet. All drivers, when belted in, must not be able to extend their head over the roll cage!

### **C. *Helmets, Shoes and Clothing***

1. The driver must wear a motorcycle type helmet (DOT approved, or equivalent) with eye protection. A hard shell bicycle type helmet will NOT be allowed. (Helmets will be inspected for damage and safety items such as chin straps, cracks, missing padding, etc.)
2. Closed-toed shoes are required to be worn during the performance run. Sandals are not allowed.
3. Long pants and full length socks (ankles must be covered).

### **D. *Fuel and Lubrication Systems***

1. Fuel and lubrication systems should be designed so that any loss of fluids will not result in a fire hazard.
2. Pressurized tanks will not be allowed.
3. All push-on fuel lines fittings must be clamped. Secure loose lines to the vehicle.
4. Care should be taken to provide a readily accessible mounting location for the fuel tank. Lines should be long enough, and in clear view, to remove all air bubbles.
5. All fuel tanks must stand straight up. No tilting of tanks in any way will be allowed.
6. All fuel lines must be clear and colorless plastic and no longer than 24 inches in length.
7. Gas filters are optional. They must be clear to visibly remove any bubbles that may occur during any runs. They must be installed within 6 inches of the fuel bottle. Filter must be installed prior to Tech. Inspection. (Note- be sure to install the filter in the correct direction).

### **E. *Brake System***

1. The brake system must be adequate for safely stopping the vehicle in a reasonably straight line. It must hold the vehicle and driver on the 15 degree ramp in a static position.

### **F. *Fire Extinguisher***

1. A multipurpose (min. 2 lb., larger recommended) ABC dry chemical fire extinguisher, rating No. 1A10BC or equivalent must be provided.
2. The extinguisher must be securely mounted so that the driver can direct the extinguishing agent on the fuel tank and engine area.
  - a. If the driver has sufficient freedom of movement in the event of a fire to remove the extinguisher from its bracket and direct it on the above mentioned areas, the design will be allowed.
  - b. If the driver does not have sufficient freedom of movement, some method must be provided to accomplish the desired result (i.e.: a system of tubing and remote actuation). Remote actuation is preferred; if a tubing delivery system is used, ½ in. diameter tubing of no more than 30" length can be used.
  - c. Alternate delivery systems will be allowed but only if actual test result documentation is available through a faculty advisor.
3. All fire extinguishers must be equipped with a manufacturers installed pressure/ charge gauge. Gauge must be readable for Tech Inspection and must read Full.
4. All teams are required to have in their pits a large (minimum 5 pound) ABC fire extinguisher indicating Full. This must be with you when going through Technical Inspection.
5. **It is the responsibility of the teacher (advisor) to provide training to all team members with proper use of fire extinguishers being used in this competition.**

#### ***G. Exhaust System***

1. Engine exhaust must exit the vehicle body (exhaust cannot be enclosed).
2. Tail pipes must be added to the muffler to clear the body. The muffler must remain in the factory position in Stock class.

#### ***H. Fire Wall***

1. A wall of steel or aluminum material of 0.032 in. minimum thickness must separate the driver from the engine.
2. The fire wall cannot interfere with the operation and use of the fire extinguisher.

#### ***I. Exit ability***

1. The driver must be able to quickly exit the vehicle under 15 seconds, unassisted, in case of an emergency. **(A driver will be required to demonstrate this at the time of inspection.)**

#### ***J. Rear View Mirror and Rear Visibility***

1. All vehicles must be equipped with at least two (2) rear view mirrors that have a minimum of 7 square inches. Mirrors must give the driver a clear view to the track area behind the vehicle.
2. During inspection the drivers will identify 8" geometric objects at a distance of 15 feet, while the engine is running!
3. Drivers must have adequate visibility to avoid collision with other vehicles and maintain course direction. Rear view mirrors, side mirrors or rear view cameras must be used to provide visibility.

#### ***K. Visibility***

1. The driver must have good visibility forward and to each side from 90 degrees from dead ahead.

#### ***L. First Aid Kit***

1. Each team is required to have with them, a large TEAM first aid kit. This must be with you when going through Technical Inspection.
2. The contents will be left up to the discretion of each school (teacher/sponsor) and team. It is good to include burn ointment and large gauze pads.
3. Large (school type) first aid kits are very good.

#### ***M. Seat Belts***

1. Each driver is required to be belted in using an automotive type seat belt.
2. One lap belt across the driver's waist will be sufficient.
3. No tape or rope type harnesses will be allowed. Not necessary to have a shoulder belt at this time, but it is highly recommended.
4. Five point parachute or Jr. Dragster type harnesses are superior, but not required.

**\*\*\*CAR NUMBERS WILL BE GIVEN TO THE INSTRUCTOR UPON SUCCESSFUL COMPLETION OF TECHNICAL INSPECTION!!**

### **III. PERFORMANCE RUN:**

Each vehicle will be required to complete two (10) laps around the .6 mile track area. All vehicles will be required to maintain an average lap minimum speed of 15 mph (24 Km/hr.) and a DNF (Did Not Finish) penalty will be assessed to any vehicle exceeding the allowed time. Maximum run time is 24 minutes. Minimum run time is 12 minutes. **MAXIMUM SPEED IS 30 MPH. (enforced by radar and average lap speed)**

#### ***A. Start***

1. Prior to the performance run an official fuel tank (supplied by each participant, fuel tanks will not be made available at the race) will be filled, weighed and installed on the vehicle. The start of the performance run will begin with the vehicle being placed just behind the start line. The vehicle engine is then started, either by driver or pit crew. Timing for the minimum mph requirement starts when the vehicle crosses the start line. **VEHICLES CANNOT BE PUSH STARTED.** Transmission design must be such that the engine can be disconnected from the driving wheel/wheels to allow the vehicle to coast or remain stationary with the engine running.

#### ***B. Finish***

1. Upon successful completion of the performance run the timers will record total elapsed time. The fuel system cannot be touched until approval is given by an official. Tanks will be removed and weighed by the judges. The miles-per-gallon rating for the vehicle will then be computed by dividing the distance by the amount of fuel used (D/F). If the maximum allowable elapsed time has been exceeded, the penalty will be a DNF.
2. Teams best (4) runs will be averaged for the challenge. Teams have the opportunity to make as many runs as time allows.

#### ***C. Driving Notes***

1. Cars coasting are required to stay to the right-hand side of all track areas.
2. Cars accelerating are required to keep to left side track areas.
3. Always look for other cars while driving, especially during accelerating!
4. Teachers/Advisors will not be allowed in the pits during testing and competition except to check on student progress. **Teachers/Advisors will be encouraged not to work on vehicles.**
5. Teachers/Advisors will be assigned jobs upon completion of Technical Inspection. These tasks are during competition activities, such as timers, spotters, or re-fuel personal.

**TEACHERS REPORT TO THE HEADQUARTERS TENT FOR ASSIGNMENT(S).  
TEAMS WHOSE TEACHER/SPONSOR DOES NOT PARTICIPATE IN  
ASSIGNMENT(S) MAY BE DISQUALIFIED FROM COMPETITION.**

6. A team will consist of no more than 15 students. Advisor is responsible for all team members. Additional students may attend as spectators.
7. Once a driver has started a run he/she is the only person that can make repairs while the vehicle is on the track - pit crew members can get tools but cannot assist in any repair work!
8. Vehicles will be allowed to coast during mileage runs. Coasting vehicles must have a system for the driver to restart the engine.
9. Assigned judges will monitor vehicle speed during competition. Any vehicle that is driving excessively fast or recklessly will receive a warning and that driver will be suspended from anymore driving (including testing in pit areas), wrist band will be removed. A second violation will suspend a vehicle or team from any further competition!
10. No radar detectors will be allowed on vehicles.
11. Speed limit is 30 MPH.

#### **IV. Behavior**

This is a school activity and MSSHA rules will apply.

#### **V. Teacher/Advisor Responsibilities**

1. All teams must have **an** official teacher/advisor present at all times during the competition.
2. Teacher/Advisors will **ALL** be assigned duties in support of the competition. Teachers/Advisors not willing to perform race day duties will forfeit their team's right to compete and will be asked to leave the race facilities.

#### **VI. Insurance and Safety**

1. Insurance and safety is the responsibility of each school that enters the competition. Teachers should make sure they follow their individual school guidelines (such as parental consent forms) and MSSHA guidelines. **University of Central Missouri assumes no responsibility for injury to participants or spectators or for property damage to student competition vehicles, school owned vehicles or privately owned vehicles.**

#### **VII. Pit Crew Rules**

1. Pit crew members and drivers must have official wrist bands on to be in the pit or be driving (NO EXCEPTION).
2. An oil-shield tarp covering the area of the vehicle must **be** on the ground at all times.
3. Pit area must be kept clean and in an orderly manner at all times.
4. There must be a designated Pit-Crew Chief in the Pit at all times.
5. There must be at least one Pit-Crew member in the Pit at all times.
6. Fire Extinguisher must be in a readily accessible location in the Pit.
7. There is to be absolutely NO "horseplay" in the Pit at any time.
8. Pit-Crew members and teacher/advisor must follow the directions of the Pit Official at all times.
9. In case of vehicle break-down on the track, only TWO (2) Pit-Crew members are permitted to attend the vehicle. The Pit Official must give the ok for Pit-Crew members to go to the vehicle. VIOLATION OF THIS RULE MAY RESULT IN THE DISQUALIFICATION OF TEAM.
10. Pit-Crews will be required to clean the Pit Area completely at the end of the competition.

## **VIII. Entry Fees and Entry Date**

1. No entries fees will be collected this year. This means that each competing school must provide there own lunch, and any other cost associated with the competition.
2. FIVE DOLLARS WILL BE COLLECTED ON RACE DAY FOR EACH ENTRY FOR FUEL AND TROHPY COST.
3. Entries must be post marked by February 15<sup>th</sup> , 2010
4. Send entries to:

Carter Fawkes  
Marshall High School  
805 Owl Pride Drive  
Marshall, MO 65340  
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