

# EV Challenge Rules of Competition

## Version 11, February 2007

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### SECTION I – GENERAL OBJECTIVES

A. The EV Challenge is an education program with the objective of furthering the knowledge of students and the general public about electric vehicles, electric vehicle technology, and the need for clean transportation fuels. All participants shall be required to implement these rules and other event instructions in a manner which will maximize the opportunity for accomplishing this objective.

B. Event officials, as defined by EV Challenge personnel, shall have the final interpretation of these rules. Decisions associated with interpretation and implementation of these instructions and the conduct of the events are final.

C. Written event-specific instructions may be provided to each school at least 30 days prior to that event. Event-specific instructions shall supersede any other instructions provided to participants.

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## **SECTION II – GENERAL VEHICLE RULES**

A. All vehicles shall have a current state safety inspection sticker (vehicles from states that do not require state safety inspection will require a statement from the school faculty indicating the vehicle meets all state requirements and will receive a detailed safety inspection by event personnel (see “High School EV Challenge Electric Vehicle Specifications), current state license tag, and appropriate state-required liability insurance.

B. All vehicles will be inspected for compliance with the "High School EV Challenge Electric Vehicle Specifications."

C. All vehicles must have a permanently fixed manufacturer’s identification tag that indicates the vehicle’s Gross Vehicle Weight Rating (GVWR). If this tag is not available, suitable documentation to indicate the production GVWR may be accepted by event officials. Participants shall submit this documentation to event officials at least 60 days prior to the Final Event.

D. If a school is building a new vehicle, school personnel must inform EV Challenge officials of the vehicle make, model, and GVW rating before the school begins the conversion process. This will ensure that the vehicle will fit appropriately into one of the EV Challenge classes.

E. Vehicles are required to pass safety inspections at each of the dynamic events, including the autocross and range event.

F. Designated areas will be established for the repair of vehicles at the events. Vehicle repairs outside of those areas will only be permitted with approval of event officials.

G. Vehicles shall be required to meet all applicable laws and regulations.

H. Vehicles shall be operated in a safe and legal manner at all times. Unsafe or reckless operation of vehicles, speeding, or failing to comply explicitly with traffic laws will result in penalty and/or disqualification.

I. Seat belts must be available and worn by all vehicle occupants.

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## **SECTION III – VEHICLE DRIVERS**

A. All driving events require high school student drivers.

B. Vehicle drivers shall have a valid driver's license. Students with learner's permits will not be allowed to drive in the events.

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## **SECTION IV – INSURANCE WAIVERS**

A. Vehicle drivers, pit crews and others who are actively involved in any dynamic event (autocross, range, etc.) are required to sign insurance waivers provided at any event.

B. Minors (under 18 years old) are required to bring the completed “Parental Consent” and “Minor’s Assumption of Risk Acknowledgment” forms to every dynamic vehicle event (Northampton Rally, Final Event, etc.). These forms are available in the “for schools” section of the EV Challenge web site.

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## **SECTION V – SCHOOL CLASSIFICATION AND VEHICLE CLASSES**

### **A. School Classification**

Participating schools that are building their first conversion vehicle will be classified as “Novice Schools.” “Veteran Schools” are those schools that have built a conversion vehicle in a prior year.

These classifications are mainly used as a way to help organize the program. All schools may compete against one another in the overall program, regardless of classification.

1. Novice Schools must enter the Car or Truck Class.
2. For the School Initiative event ONLY, schools must participate in activities that correspond to their classification. See the School Initiative Activity Form for details.
3. A Rookie-of-the-Year trophy will be awarded to the overall top Novice School.

### **B. Multiple Teams from One School**

A school may only enter up to two teams in the EV Challenge. However, each team must have their own separate:

- Troubleshooting team
- Oral presentation
- Vehicle for the Autocross, Range and Vehicle Design Events

A school must use the same score for each of its teams for the School Initiative event and Web Site Competition. Schools should be prepared for competition events to be run concurrently, and may want to have different students identified for each competition event.

### C. Vehicle Classes

For the vehicle-specific events such as Autocross, Range, and Vehicle Design, vehicles will be divided into three separate classes – Car, Truck, and Modified. These vehicle classes will ONLY apply to the vehicle-specific events. See Section II of the “EV Challenge Vehicle Specifications” for technical details.

The Car and Truck Classes are intended to provide all schools with a solid platform upon which to build a totally stock vehicle and learn basic electric vehicle technology. The Modified Class is designed to provide successful Veteran schools with an opportunity to expand their program by building a more technically sophisticated vehicle. After Novice schools have successfully built a Car or Truck Class vehicle during their first year, they may seek Challenge approval to build and enter a Modified vehicle for the Challenge program in subsequent years.

There must be at least four vehicles to constitute a class. If there are less than four vehicles in a class, the vehicles will be moved to another class.

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## SECTION VI – EVENTS

**The EV Challenge competition consists of the following seven events. Each event counts toward the schools overall score. Events and how they count on the overall score are listed below:**

- A. [Trouble-shooting](#); 10%; students diagnose electrical and mechanical faults in an EV.
- B. [Web Site Design](#); 10%; students design and create a web site that effectively describes a school’s program and the environmental benefits of electric vehicles.
- C. [Oral Presentation](#); 10%; students prepare two presentations that are to be given in a live oral competition that effectively describes a school’s program and the environmental benefits of electric vehicles.
- D. [Autocross](#); 10%; students drive vehicles through a slalom course in a timed event.
- E. [Range](#); 10%; students drive the vehicle as far as it will go.
- F. [Vehicle Design](#); 20%; judges assess the design of vehicles.

G. [School Initiative](#); 30%; teams are rewarded for participating in a wide variety of events and activities throughout the year.

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## SECTION VII – TROUBLESHOOTING

A. The troubleshooting event is intended to test students' electric vehicle troubleshooting skills and general electric vehicle knowledge.

B. Overview

1. Each school team shall form a troubleshooting team of 2 students.
2. Two Parts of Event
  - a. Part 1 – Written Assessment – 7 minutes
  - b. Part 2 – Identify Faults on Troubleshooting Board – 7 minutes

C. Part 1 – Written Assessment

1. Students will be given a written assessment that contains 21 questions. The 21 questions will be made up of 20 multiple-choice questions and 1 short answer question. No notes, scratch paper, or other aids will be provided or allowed.
2. The two students will work on the assessment together. They may wish to divide up the questions in an effort to answer all 21 questions in the 7-minute time period.
3. The assessment will test the students' general knowledge of electric vehicle troubleshooting and electric vehicle components.
4. Students may prepare for the assessment by reviewing the EV Technology Pre- and Post-Test and the "Troubleshooting an EV" lessons in the EV Challenge Curriculum.

D. Part 2 – Identify and Fix Faults on a Troubleshooting Board

1. Part 2 of the event will utilize a specially designed "Troubleshooting Board."
- B. The students' goal is to identify and fix 2 electrical faults placed in the troubleshooting board in the least possible time.
  1. Students will be given 7 minutes to identify and fix the 2 faults. If students correct both faults in less than 7 minutes, the time will be recorded and used for tie-breaking purposes only.
  2. Students will be able to use a multimeter, the board's wiring diagram, and a pen/pencil/paper (if needed). The wiring diagram is available in the "for schools" section of the EV Challenge web site.
  3. Use of a multimeter is the primary way that students will be able to correctly identify the faults.
  4. Students will be required to diagnose and "fix" the faults by replacing faulty components or wiring. Appropriate components and wiring will be provided. Tools will not be needed to replace or fix the faults.

5. Although an EV Challenge multimeter will be available, students are strongly encouraged to bring their own multimeter to the event.
6. Safety glasses are required. Although EV Challenge safety glasses will be available, students are strongly encouraged to bring their own safety glasses to the event.

#### E. Scoring

1. Part 1 – Written Assessment – 50%; 10 points for short answer, 40 points for multiple choice. 50 points total.
2. Part 2 – Troubleshooting Board – 50%; 25 points for correctly fixing each fault, 50 points total.
3. 100 points total for entire event.
4. The winner of the event will be the team with the highest combined score from Parts 1 and 2.
5. Ties will be broken using the following:
  - a. The shortest time used to fix both faults on the Troubleshooting board.
  - b. The highest score on the written assessment.
  - c. The highest score on the short answer section of the written assessment.

#### F. Troubleshooting Board Description

1. The EV Challenge Troubleshooting Board has been specially designed for the Troubleshooting event. The board fits on a tabletop and simulates the operation of the electrical system in a typical EV Challenge vehicle. The board utilizes a 36-volt high voltage system and a 12-volt low voltage system.
2. The board is equipped with the following components:
  - a. 36-volt Curtis controller
  - b. Curtis 0 – 5000 ohm pot box (potentiometer)
  - c. 3 12-volt sealed batteries that make up a 36-volt battery pack
  - d. A sealed 12-volt auxiliary battery
  - e. DC permanent magnet motor
  - f. Albright main contactor
  - g. On/off key switch
  - h. High voltage main disconnect
  - i. High voltage main fuse
  - j. 2 12-volt fuses
  - k. “Test-points” that correspond to the numbers on the wiring diagram
  - l. Jumper wires and spare components will also be provided
3. The board operates as follows:
  - a. Step 1: Make sure that the main disconnect is closed
  - b. Step 2: Turn key switch on
  - c. Step 3: Move lever on potentiometer. Motor should rotate.
4. How the Troubleshooting board will be used during the event:
  - a. Step 1: Students will be given a wiring diagram of the troubleshooting board and presented with a brief video of the troubleshooting board’s operation. Students will be provided with 10 minutes to review these

materials. Students will not be able to view the actual board during this time.

- b. Step 2: Students will then be taken to a separate room where the troubleshooting board will be located. Students will be given a one-minute overview of the board. After the overview, students will be given 7 minutes to find and fix the faults.
  - c. The faults may be fixed by using jumper wires or by replacing a faulty component(s). The jumper wires and components will be provided. No tools will be necessary.
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## **SECTION VIII – WEB SITE DESIGN**

### A. Primary Objectives

1. To provide an opportunity for students from computer-related classes to participate in the EV Challenge.
2. To introduce sponsors, parents, the news media, and the general public to a school's electric vehicle program.

### B. Web Site Structure

1. The web site should contain only four separate pages. These pages must be linked together. The four pages should contain the following content:
  - a. 1st Page – Overview  
An overview of a school's EV program, including program history, what classes and instructors are involved, what students learn by participating in the program, a history of any awards the program may have received, a summary of news media coverage, and other significant activities, publicity, achievements, and awards.
  - b. 2nd Page – Electric Vehicle Description  
Provide a description of the school's electric vehicle. This should include the make, model, year, when it was converted, and a thorough list of the electric vehicle components and specifications (batteries, motor, controller, voltage, charger, special features, etc.). If a school has several electric vehicles, information should be provided describing each.
  - c. 3rd Page – Community  
Provide a complete list of all local community sponsors. Provide links to their web sites if possible. Also list and describe all of the ways that the EV program gets involved in the community. This should include the School Initiative activities performed that involved the public and community leaders
  - d. 4th Page – Environmental Benefits  
Provide an explanation of the environmental benefits of EVs (energy, air, water, etc.) and how they address environmental issues associated with transportation fuels. At least two professional sources should be used to support the environmental information presented. These sources must be referenced on the web site. These sources may be a

professional journal, a business/industry report, or information from a government agency. (Newspapers are not considered a professional source, although newspapers can often lead you to a good professional source of information.) You may use the same information and information sources that you use for other Challenge competitions that involve the environmental benefits of electric vehicles.

2. The entire web site must fit on a single 3 ½" floppy disk.
3. All files necessary to run the web site must be contained on the floppy disk.
4. The web site must be designed to run from a single common directory.
5. The first file (file that loads and runs the web site) should be named index.htm. If "index.htm" is not used for the name of the first file, then the name of the first file must be clearly labeled on the disk.
6. All programming must be in HTML and may not include Java, Shock Wave or similar languages or require browser "plug-ins".

#### C. Scoring

1. The web site will be scored using a Web Site Judging Sheet such as found in the "for schools" section of the EV Challenge web site.
2. Each page of the web site will be scored separately.
3. The Content section of each page will be scored by official EV Challenge judges. Additional components of each page will be scored using objective measures and automated tools, such as HTML verifiers and online web site diagnostic services.

#### D. Submitting the Web Site

1. The floppy disk containing the web site must be sent to: EV Challenge Web Site Competition  
PO Box 37807  
Raleigh, NC 27627
2. The mailing must be postmarked by, March 3, 2007

#### E. Basic Strategy

1. The EV Challenge strongly encourages schools to complete the web site several weeks ahead of the deadline. This will allow ample time to review and revise the web site.
2. The EV Challenge strongly encourages schools to use HTML verifiers and online web site diagnostic services to aid in the development of the web site. Not only will one of these services be used to judge the web site, but these services provide valuable web site design assistance.
3. Past competitions demonstrated several common mistakes in web site preparation. These include:
  - Failure to consistently capitalize graphic file names. Many file servers are case sensitive and will not overcome inconsistent capitalization.
  - Failure to follow rules pertaining to sub-directories and file names.

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## **SECTION IX – ORAL PRESENTATION**

- A. The oral presentation is designed to test students' professional oral presentation/speaking skills only. As such, no slides, overheads, pictures, props, PowerPoint systems or other hand-held presentation devices may be used.
- B. The Oral Presentations will be judged in two stages at the Final Event: the Qualifying Stage and the Final Stage.
1. Qualifying Stage
    - a. Students shall create a three-four minute presentation. This presentation will be given on the first day of the Final Event.
    - b. The top ten presentations will be selected.
  2. Final Stage
    - a. The top ten presenters from the first session will give a five-seven minute presentation during the later during the day.
    - b. The second presentation must be given by the same student(s) who presented in the morning.
- C. Oral Presentation Guidelines
- Both the Qualifying and Final Presentations must follow these guidelines and the Oral Presentation Judging Form.
1. Provide an overview of a school's electric vehicle program. This shall include a description of your program's vehicles, what classes are involved, a list of your community sponsors, a history of your program, the successes and challenges, how obstacles have been overcome, the importance of teamwork, what has been learned, interesting stories, etc.
  2. Give a thorough and accurate explanation of how Plug-In Hybrid Electric Vehicles work and how that technology is being developed for use in vehicles.
    - a. Presenters shall provide accurate information and demonstrate a thorough understanding of the issues associated with the development and use of PHEV's.
    - b. At least two professional sources must be cited to support the information presented. These sources may be a professional journal, a business/industry report, or information from a government agency. (Newspapers are not considered a professional source, although newspapers can often lead you to a good professional source of information.)
  3. Up to two people can participate in the oral presentations.
  4. Presentations are of a professional nature and business attire shall be worn. Refer to the Oral Presentation Judging Form for specific information.
  5. Presentation will be given at a podium before a live audience.
  6. Skits are not acceptable. Characterization, costumes and/or props must be avoided.

7. Both the Qualifying and Final Oral Presentations will be judged by a panel of at least three judges.
  8. The presentation will be scored using the Oral Presentation Judging Form found in the “for schools” section of the EV Challenge website. Use this form to guide the development and rehearsal of your presentation!
  9. If a school has two participating teams, each team shall separately participate in the Oral Presentation.
  10. Each presentation must be completed within the time provided. Qualifying presentations will be stopped at the four-minute mark. Final presentations will be stopped at the seven-minute mark.
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## **SECTION X – AUTOCROSS**

- A. The autocross will be conducted under the direction of the Tarheel Sports Car Club.
- B. Each team will be allowed a specified number of timed runs. These runs may be taken by the same driver or by different drivers. All runs must be completed within the time period specified by event officials.
- C. Runs are timed to the nearest 0.001 second. In the event that two or more teams' selected run is equal to the nearest 0.001 sec, the tie will be broken using the team's best remaining run.
- D. If a driver fails to make all gates marking the course, the run will be marked as a DNF (Did Not Finish) and no time will be awarded.
- E. A 2 second per cone penalty will be assessed for each cone hit resulting in the following:
  1. Any cone knocked over
  2. Any cone knocked out of the marks by the base of the cone, even if the cone is still standing.
- F. A cone penalty is not assessed if a cone is bumped, remains standing, and any portion of the base of the cone remains inside the marks by the base of the cone.
- G. If you notice a cone out of place during your run, you have the option to stop and point the cone out to a course worker. If the cone is out of place, you will be given a re-run.
- H. All drivers must wear helmets and use their seat belts.
- I. All vehicles must pass a technical inspection by Tarheel Sports Car Club and EV Challenge personnel. Particular attention will be paid to tire pressures. No loose objects will be allowed in the car. Only Modified Class vehicles may be allowed to use a DOT-

approved competition tire. Car and Truck Class vehicles must use the same tires and wheels used in the range event.

J. Drivers may walk the course as many times as desired during the time allowed. Bicycles or other such forms of transportation may not be used to see the course.

K. At a minimum the driver's window must be all the way down. Having both sides down is preferred.

L. Passengers will not be allowed during any runs.

M. The driver must keep his/her arms inside the vehicle at all times while on course.

N. If you are red-flagged, come to a complete stop and follow the instructions of the course worker.

O. Striking any timing equipment or the large cones marking the timing equipment will result in an automatic DNF.

P. A car that starts its run but is unable to complete the run for mechanical reasons will be given a DNF for that run.

Q. In the event of timer malfunction, the car(s) involved will receive a re-run.

R. If a car is red-flagged for something that is not the responsibility of the driver (e.g., a animal wanders on course) the driver will receive a re-run.

S. Teams will run in the order designated by event officials. After completing a run, a team must return to the end of the line unless directed to do otherwise by event officials.

T. Teams that are not in place and ready to begin their run when it is their turn will forfeit that run.

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## **SECTION XI -- RANGE**

A. Each vehicle must follow the pace car. Vehicles that pass the pace car will be subject to disqualification.

B. Teams will be allowed to pass other team vehicles only if necessary to maintain the pace set by the pace car. The pass should be completed safely and in compliance with applicable laws and regulations. Passing in an unsafe or illegal manner will result in disqualification.

C. Vehicles that are unable to proceed at a safe speed must pull completely off the road as soon as it is safe to do so. If the pace vehicle pulls up behind a vehicle and flashes its lights, blows its horn, or otherwise signals to the driver, the vehicles must pull completely off the road as soon as it is safe to do so. Team members should remain with their vehicle, unless doing so presents a hazard, and then they shall exercise judgment that will minimize the risk to themselves and to others.

D. Teams that experience vehicle failure shall ensure that their vehicle is parked safely off the road and out of the flow of traffic. Team members should remain with their vehicle, unless doing so presents a hazard, and then they shall exercise judgment which will minimize the risk to themselves and to others.

E. Any vehicle that is passed by the pace car shall pull off the road as soon as it is safe to do so. Team members should remain with their vehicle, unless doing so presents a hazard, and then they shall exercise judgment that will minimize the risk to themselves and to others.

F. At the point the pace car passes a vehicle, mileage is marked and the vehicle passed is retired from the event.

G. Mileage calculations are performed by event officials and their decision is final.

F. Passengers are not allowed during the range event.

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## **SECTION XII – VEHICLE DESIGN**

A. Refer to EV Challenge Vehicle Specifications regarding the design objectives for EV Challenge vehicles.

B. Vehicle design will be judged according to a design competition score sheet found in the “for schools” section of the EV Challenge web site.

C. A minimum of three design judges will score the vehicles and the results of all the judges will be combined to determine each vehicle score.

D. Each design judge will be required to judge all the participating vehicles.

E. During the design competition, a student must be with the vehicle to answer any questions that the design judges might ask.

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## **SECTION XIII – SCHOOL INITIATIVE**

A. The School Initiative category awards points to schools for participating in a wide range of activities throughout the year. At 30% of the overall score, this is the most valuable event in the EV Challenge series.

B. Schools are rewarded for participation only. Any school that earns 150 or more points will be awarded first place EV Challenge points for this event. The top three scoring schools will receive trophies. Specifics of the scoring system can be viewed in [Section XIV.B.](#)

C. Once a school has determined its Novice or Veteran standing (see [Section V](#)), the school will begin completing activities from the appropriate section of the School Initiative Activity Form. This form is available in the “for schools” section of the EV Challenge web site.

D. All activities must be recorded on the School Initiative Activity Form. This form must be sent to the EV Challenge and postmarked no later than March 4, 2005. The forms must be sent to the address on the front of the forms.

E. This event will be judged on the honor system. An honest accounting of what activities a school participated in is required.

F. All School Initiative activities must take place between May 15, 2004 and March 4, 2005.

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## **SECTION XIV – SCORING AND AWARDS**

### A. Overall Scoring

EV Challenge points for each event will be added together to obtain an overall score. Lowest overall score wins the EV Challenge.

EV Challenge points are awarded based upon where a team places in each particular event. For example, if a team places 3rd in the troubleshooting competition, that team earns 3 EV Challenge points. If a team places 7th in the autocross, that team earns 4 EV Challenge points.

The table below indicates the number of points awarded based upon where a team places in each event.

<b>Place in Event</b>	<b>School Initiative</b> -- 30%	<b>Web Site</b> --	<b>Troubleshooting</b> -- 10%	<b>Oral Presentation</b> -- 10%	<b>Autocross*</b> -- 10%	<b>Range*</b> -- 10%	<b>Vehicle Design*</b> -- 20%
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		<b>10%</b>					
<b>1st</b>	3	1	1	1	1	1	2
<b>2nd</b>	6	2	2	2	2	2	4
<b>3rd</b>	9	3	3	3	3	3	6
<b>4th</b>	12	4	4	4	4	4	8
<b>5th</b>	15	5	5	5	4	4	8
<b>6th</b>	18	6	6	6	4	4	8
<b>7th</b>	21	7	7	7	4	4	8
<b>8th</b>	24	8	8	8	4	4	8
<b>9th</b>	27	9	9	9	4	4	8
<b>10th</b>	30	10	10	10	4	4	8
<b>11th or Greater</b>	35	11	11	11	4	4	8
<b>DNE**</b>	50	20	20	20	10	10	20

\*Autocross/Range/Vehicle Design -- The Car, Truck, and Modified classes will be scored separately for these three events.

\*\*DNE -- Did not enter

#### B. Scoring for the School Initiative activity

As indicated in [Section VI](#), the School Initiative activity is worth 30% and thus schools will earn three times as many points in this event.

<b>School Initiative Score</b>	<b>EV Challenge Points</b>
133 or greater	3
125-132	6
117-124	9
109-116	12
101-108	15
93-100	18
85-92	21
77-84	24
69-76	27
61-68	30

### C. Tie-Breakers

The first tie-breaker will be a school's total score in the School Initiative event. The second tie-breaker will be the school's Vehicle Design score.

### D. Penalties

1. In the event that vehicles do not explicitly meet the rules of the competition but are still allowed to participate in events, penalties may be assessed to scores and/or event rankings.
2. Penalties shall be assessed at the sole discretion of event organizers.

### E. Awards

1. Trophies will be awarded for:
  - First – Third in each event
  - First – Third Overall
  - Rookie of the Year
2. Prize Money (subject to change)
  - \$1000 for First Place Overall
  - \$750 for Second Place Overall
  - \$500 for Third Place Overall
  - \$250 each for remaining entrants that complete all 7 of the required EV Challenge activities