

***Year 2009***  
***Human Powered Paper Vehicle Competition***  
*Hosted by*  
*Eastern Washington University*

(Note: No changes have been made from last year's rules)

This coming spring, Eastern Washington University will be hosting this premier engineering competition. A group of regional colleges are being invited to participate in this year's, 12th annual event. This engineering competition inspires students, challenges their engineering skill and creativity, and provides a competitive format that limits the cost of fielding a team.

The basic idea is to construct a human powered vehicle out of 90% paper products (by weight). The remaining 10% is limited only by the imagination of the designers. There is a maximum allowable vehicle weight of 75 pounds. There will be two parts to the overall competition. One will test vehicle performance and another will test presentation skills. We hope that this project will help develop student excellence in team work and communication.

We hope that you will join us. Last year we had teams from all across Washington State and we are expecting continued growth this year.

If you have questions about the competition contact:

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Visit our web site at  
<http://www.technology.ewu.edu/hppv/main.htm>

## **Entry and Registration**

Each school may field multiple teams. Each team must consist of four student members, an exception will be allowed for a three person team if it is approved by the competition committee at or before the teams registration. Teams with more than four members must be approved before the competition and a valid reason must be presented for extra members. All awards are based on a four-person team and additional awards will not be provided for larger teams. All members of the respective school's team must be current students enrolled in that school. The host school reserves the right to submit the roster to the respective school registrar's office for verification.

The team roster must clearly identify the team members. Every team member must take part in at least one portion of the competition. In the case that a team member is absent or a substitution is necessary, it will be allowed only at the discretion of the judges.

### **Submittal of Entries**

Entries, which indicate an intent to participate in the competition, must be received by the host organization no later than April 1, 2009. Entries must include the following:

- A completed copy of the entry form which includes identification and contact information for a single-person contact for the team.

At its sole discretion, the host school may allow consideration of entries received after the entry date.

### **Notification of Acceptance**

Notification of acceptance will be sent no more than one week after receipt of the entry. If you do not receive verification within one week, please contact:

**Donald Richter**

(509) 359-2880

E-mail: Donald.Richter@mail.ewu.edu

### **On-Site Registration**

All competitors must register with the competition committee upon arrival at the campus.

Registration will take place at the Field House, between 8:30 AM and 10:00 AM. (*Note:*

*Competition and registration times may be adjusted to accommodate a large turnout and/or to facilitate teams that must travel. Teams will be notified ahead of time if any changes are made.*)

The on-site registration process will include:

- Submittal of a signed "Acknowledgment of Rules" form.
- Submittal of non-paper materials log sheet, *signed by a faculty rep with contact info;*  
(*An official log sheet is located at the back of this document*)
- Requests for changes in the list of participants;
- A schedule and other appropriate event information will be distributed.
- Submission of presentation bonus point items:  
***Only items submitted during registration will be counted toward presentation bonus points. Items must be submitted separate from the report and presentation to receive presentation bonus points.***

- ⇒ A written report (*separate form the presentation*) on the team's design and build process submitted as a printed hard copy or in MSWord on a floppy, zip disk or CD. This should include a description of what and how materials were used to achieve the teams design. Please use only the formatting types listed. **(+1 points per judge)**
- ⇒ Photos of vehicle assembly process. **(+1 point per judge)**
  - \* Original photo prints or 1024x768 (or higher) resolution digital images in .jpg format.
- ⇒ VHS video footage of assembly process. **(+1 point per judge)**
- ⇒ Floppy, Zip disk or CD containing graphics, CAD diagrams, scanned hand drawn diagrams, *no clip-art*. **(+1 point per judge)**
  - \* CAD graphics must be converted to DWG, DXF and DWF, .bmp, .gif or .tif formats.

## **General Rules of Competition**

### **Vehicle Design, Analysis, and Construction**

The research, analysis, and design of all vehicles entered by a school must be performed solely by current students enrolled at that school and listed on the roster.

Materials: At least 90% of the vehicle (by weight) must be made from paper or paper products. Adhesive weight (tape\*, glue\*\*, etc.) used on the vehicle is not counted toward non-paper weight. **The vehicle's total weight may not exceed 75 pounds.**

**REQUIRED:** Materials Log Sheet: A complete description of all non-paper components and their uses and weights must be included and submitted at the time of on-site registration (adhesives do not need to be listed). An official log sheet is located at the end of this document.

### **Verification**

The weight of all non-paper materials used in the construction of the team's vehicle must be verified by a member of the school's faculty. A non-faculty representative may be appointed by a faculty member for this purpose as long that person is not a member of any team. The faculty member's name, signature and contact phone number; and that of any appointed weight checkers must be included with the non-paper log sheet.

### **Non-Functional Weight**

All paper weight must contribute to the useful operation of the vehicle. Paper may not be added for the sole purpose of off setting non-paper weight.

## **Vehicle Re-entry**

A vehicle that has previously completed the race course may not be entered. No parts may be used from vehicles that have previously completed the race course. Vehicles, which **did not** complete the race course due to an operational or structural failure, may be re-entered or parts from that vehicle may be reused one time only.

**Tape & High Strength Fiber Cloth Restrictions:** Only those brands and grades of tape specifically listed below may be used without counting as non-paper weight:

### **Packaging Tape**

*United Tape Co.* Clear Carton Sealing Tape in Standard or Commercial Grade  
*Scotch* Super Strength Packaging Tape

### **Duct Tape**

*United Tape Co.* Standard or Contractor's Grade Duct Tape  
*Scotch/3M* High Performance Cloth Duct Tape

Standard Masking Tape is also acceptable.

Any tapes that are not specifically listed and all forms High Strength Fiber Cloth may be used only for joint re-enforcement, but must be weighed and listed in the non-paper weight materials log sheet and may not be used for structural enhancement. This includes , but is not limited to the following examples:

- **Strapping tape, Fiber reinforced tape & Poly tape**
- **Carbon fiber, Fiberglass & Kevlar cloths**

\*\*Glues are to be used solely in an adhesive capacity (i.e. parts molded from glue must be counted as non-paper material weight).

The vehicle may be painted as long as the paint does not contribute to the performance of the vehicle.

## **Functional requirements**

- Only human power may be used to drive the vehicle. The rider is not allowed to physically touch the ground during the competition, either with his/her feet or with any other part of his/her body. Each infraction will result in a performance penalty equal to **10%** of total course time.
- The vehicle must be powered by three different riders and be able to support a minimum rider weight of 120 pounds.
- The vehicle must accommodate both steering and braking.
- The vehicle must be capable of completing the course including the ramp bridge which incorporates a 10.6° incline and decline.
- The weight of the vehicle may not exceed 75 pounds.

## Performance Penalties:

- ***Exceeding the 10% Weight limit:*** No vehicle may exceed the 10% non-paper weight limit by more than 0.50 pounds. ***Any vehicle with a non-paper weight greater than 10% plus 0.50 pounds will be disqualified from the performance portion of the event.*** Vehicles which exceed the 10% limit by 0.50 pounds or less will receive the following performance time penalties.

For each 0.10 pounds that a vehicle exceeds the allowable 10% non-paper weight, a 5% time penalty will be assessed against the vehicle's performance.

*Example: If a vehicle weighs 65 lbs. but has non-paper weight totaling 6.8 lbs. It has exceeded its 10% limit by 0.30 lbs. Therefore a penalty of 15% will be added to the vehicle's actual race time. If the vehicle completed the course in 180 seconds, its final race time would equal  $180 \times 1.15 = 207$  seconds.*

The 0.50 lb. extra weight allowance is designed to allow for mistakes in weight calculating that are not discovered until the vehicle's final assembly.

## Energy Storage

No energy storage devices of any kind may be included in any competing vehicle; that is, no device -- such as one or more springs, flywheel, compressed air container, or thermal or electrochemical storage device -- specifically designed to store energy for the purpose of propelling the vehicle shall be included in its drive train.

## **Events of the Competition**

Each event will be treated as a stand-alone portion of the overall competition, although participation in both events is required. There will be separate awards for presentation and performance and equal weight will be given to each. The first place team in each category will receive a trophy for the school and medallions for each team member. The second place teams will receive a plaque for the school and medallions for each team member. A plaque for the school and medallions for each team member will be awarded second place in both categories and for “most innovative design” and “team spirit.”

### **Project Presentation**

The oral presentation provides an opportunity for the participating teams to discuss the design process and to highlight the special features of their vehicle. The presentation should include a description of the vehicle and a summary of the team’s development process. Each team will be allowed a minimum of three and a maximum of ten minutes for their presentation. Equal weight will be given to content and delivery. The presentation of their work will be evaluated by a panel of judges. The following visual-aid equipment will be provided: overhead projector, slide projector, an easel, VCR, direct read camera for overhead projection and a computer with PowerPoint (*both PC and MAC formats can be made available; the computers are set up for projection onto a large screen*).

The presentation may be given by a single team member or by a group of team members. Your goal should be to communicate your ideas effectively. Keep in mind that too much technical detail can weigh down an otherwise good presentation. This is where a cross-functional team may prove beneficial. Consider including team members from other disciplines such as business or journalism. This type of diverse team is what you are likely to face in your future work environment.

### **Penalty for Excessive Time**

Teams which run over the 10-minute maximum time limit will be assessed negative points against their score based on the following scale. The total penalty is then multiplied by the number of judges, before being added to the overall score.

10:01 - 10:30	-1 point
10:31 - 11:00	-2 points
11:01 - 11:30	-3 points
11:31 - 12:00	-4 points
Over 12: 00 minutes	Disqualified from presentation event.

*(Presentations under 3 minutes will be disqualified)*

## **Evaluation of Scores**

Winner of the presentation event will be determined by summation of raw scores of all judges plus the addition of any bonus points for supplemental items that were submitted at time of registration minus any time penalties. In cases where there are judging discrepancies, scores may be normalized. Ties for first and second will be settled by a blind ballot vote of the judging staff.

(NOTE: As a general rule, flash photography is discouraged during the presentations. Any team may state their desire to have flash photography allowed during their presentation before it begins.)

## **Vehicle Performance**

The goal of this event is to present an opportunity for students to demonstrate the capabilities of their human-powered vehicles in a balanced competition free from serious accidents.

Once the timed vehicle run starts, no one may have contact with the vehicle with the exception of the riders. This event will be scored based on course completion time and the addition of bonuses and penalties.

At the judges discretion, any team which has not completed the course within 10 minutes of their start may be asked to stop and remove their vehicle from the course. All vehicles will be allowed only a single attempt at completing the course. Exceptions to this rule and any resulting penalties will be at the discretion of the course judging staff. Protests may still be filed by opposing teams if a second attempt is allowed.

Race course details can be found on the *Fieldhouse Vehicle Performance Course Map* page. As previously noted, riders will receive a 10% time penalty for each time a rider physically contacts the floor on the course outside the transition area. Within the transition area a rider may receive a 10% time penalty for foot braking at the discretion of the transition area judge. A 10% time penalty will be assessed if the next rider enters the transition area before the vehicle has come to a complete stop. This penalty will be assessed separately for each rider transfer. A 10% time penalty will be assessed for each time a rider touches a pylon or a pullout cone.

## **Safety**

All riders must wear helmets that meet ANSI Standard Z90.4 (*standard bicycle helmet*) while:

- warming up or orienting themselves on the event course,
- riding in the event, and
- riding any competing vehicle or other human-powered vehicle in close proximity to the event course.

All surfaces of the vehicle must be free from sharp edges and protrusions, both on the exterior surfaces and in the interior in the region of the rider.

## **Fairness of Competition**

To the maximum extent possible, all participating teams will be assured equal opportunity and a fair competition. Any participating team that, in the reasoned opinion of the judges, seeks to exert an unfair advantage over other competitors will be subject to a penalty in performance points or disqualification from the competition.

## **Protests**

Teams may request to view race time and penalty sheets before final judging.

Protests must be announced to the judging staff at the time of the incident. It must be submitted to a judge in writing prior to the end of the competition.

Protest forms will be provided at the event. Written protests will be submitted on these forms. Judges will return the forms with written notification of their decision and may include comments.

Protests must be specific in nature and must include a factual account of the underlying event, rules infraction, or perceived error in the scoring of an event.

Protests will be examined and resolved by the judges, whose decision is final and without further appeal.

The decisions of the judging staff are final. Once awards have been given there will be no further protests accepted. This includes, but is not limited to, the discovery of a missed penalty found later on video review of the races.

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*Eastern Washington University, Cheney*

**ACKNOWLEDGMENT OF RULES**

Submitting School: \_\_\_\_\_

Team/Vehicle Name: \_\_\_\_\_

*I certify that our team has read the competition rules.*

\_\_\_\_\_ *We need no further clarification and have no request for variation.*

\_\_\_\_\_ *We request further clarification or variance as follows.*

Pending receipt of rules clarification or a ruling on a variance as indicated above, we agree to abide by the competition rules as stated.

\_\_\_\_\_  
Printed Name

\_\_\_\_\_  
Signature

# *Year 2009 Human Powered Paper Vehicle Competition*

*Eastern Washington University, Cheney*

## **ENTRY REGISTRATION FORM**

*Complete one form for EACH vehicle entered (photocopy if necessary).  
(This form is not required if Online registration was used)*

Submitting School: \_\_\_\_\_

Team/Vehicle Name: \_\_\_\_\_

Team Leader or Contact Person: \_\_\_\_\_

E-mail Address: \_\_\_\_\_

Mailing Address: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

Phone: Day: \_\_\_\_\_ Evening: \_\_\_\_\_

Mail this entry form to:

Donald Richter  
Chair  
Engineering and Design Department

Eastern Washington University  
Engineering and Design Dept  
319G CEB  
Cheney, WA 99004

E-mail: Donald.Richter@mail.ewu.edu

### ***Team Roster***

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_

**SAMPLE**  
*Evaluation Criteria For Oral Presentations*

Presenting Team \_\_\_\_\_

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>A. OPENING</b>	<b>Poor</b>	<b>Average</b>	<b>Good</b>	<b>Excellent</b>
1. Gained attention of audience.....				
2. Appropriate for time allowed. ....				
3. Purpose of presentation is clear.....				
<b>B. PRESENTATION</b>				
1. Prepared and organized for presentation. ....				
2. Presented information clearly.....				
3. Maintained eye contact with audience. ....				
4. Effective use of technical content.....				
5. Demonstrated an understanding of design principles.				
<b>C. CLOSING</b>				
1. Summarized main points. ....				
2. Referred back to content in opening for coherence....				
<b>D. VISUALS</b>				
1. Grammatically correct.....				
2. Professionally prepared.....				
3. Used visuals appropriately. ....				
4. Visuals simple/uncluttered; easy to read. ....				
5. Quality of technical graphics.....				
<i>Column Totals</i>				

Evaluator \_\_\_\_\_ **Total Score** \_\_\_\_\_

