

## 2010 ASME Human Powered Vehicle Challenge

### Design Scoring

Judges use this score sheet in evaluating the Design Event.

Notes:

1. Most items are worth 2 points: 0 if the area is omitted or not well covered; 1 point if included, but incomplete, unclear, or incorrect; 2 points if clear and correct.
2. The total points in each section are NOT the weight of that section. For section weight factors, please see the current HPVC rules.

<b>Design Area</b>	<b>Pts.</b>	<b>Description</b>
<b>Innovation and Design</b>	<b>20</b>	<b>Evaluated based on report and presentation</b>
		4: Teams must demonstrate that the entry is a new design (not just a new frame or fairing) completed during the current academic year, or no HPVC entry for last 4 years.
		3: Substantially new design or no HPVC entry for 3 years.
New Design	4	2: Significant new elements (frame, fairing etc) or no HPVC entry 2 years.
		1: Some new elements or no HPVC previous year.
		0: Similar to previous year's entry.
Design Methodology		
Background research	2	Substantive background section included, review of prior art.
Design Objective	2	Clear objective for the design, include mission statement for vehicle
Design Criteria/PDS	2	Well-established and stated design specification;
Alternatives and Evaluation	2	Significant alternatives should be presented. Demonstrated use of rational concept improvement and concept selection techniques.
Structured Design Methods	2	Documented use of established design methodologies, including, but not limited to QFD, Decision Matrices
DFX	2	Documented use of established design for X procedures, where X is (manufacturability, environment, etc.
Significant Innovation	2	Demonstrated evidence that some aspect of the design contributes to the art of human-powered vehicle design and/or manufacture.
Discretionary Points	2	

## Analysis

## 30 Evaluated based on report and presentation

Rollover/Side Protection System		Per 2009 RPS requirements
Top Load Modeling	2	Clearly and accurately describe constraints, idealizations, etc. Clearly describe and interpret results, score depends on results and perceived validity of results
Top Load Results	2	0: Less than 350 lb; 1: 350-599 lb; 2; 600 lb or greater
Side Load Modeling	2	Clearly and accurately describe constraints, idealizations, etc. Clearly describe and interpret results, score depends on results and perceived validity of results
Side Load Results	2	0: Less than 200 lb; 1: 200-299 lb; 2; 300 lb or greater
Computational Tools		Demonstrated appropriate and correct use of numerical computational tools such as FEA, CFD, etc.
For each analysis:		
Objective	2	Clear objective for the analysis
Load Case Definitions	2	Clearly identify and describe load cases, include rationale for each
Modeling	2	Clearly and accurately describe constraints, idealizations, use of symmetry, etc.
Results	2	Clearly describe and interpret results
Design Modifications	2	Demonstrate how results were used to modify and improve the design.
Comprehensiveness and Extent	2	More extensive use of computational tools should result in more points. 0 -- only one analysis documented, 1 - Multiple, but not extensive use, 2 -- Extensive use of computational tools
Additional Calculations		Hand calculations, student-written computer programs, spreadsheet analyses, etc.
Objective	2	Clear objective for the analysis
Description	2	Clearly describe how analysis was done. Include references if needed.
Results	2	Clearly describe and interpret results
Design Modifications	2	Demonstrate how results were used to modify and improve the design.
Discretionary Points	2	

## Testing

## 35 Evaluated based on report and presentation

Rollover/Side Protection System		Per 2009 RPS requirements
Rollover Test Methodology	2	Test method clearly described, appropriate, and scientific. Clearly describe and interpret results, score depends on results and perceived validity of results
Rollover Test Results	3	0: Less than 350 lb; 1: 350-449 lb; 2: 450-599 lb 3: 600 lb or greater
Side Test Methodology	2	Test method clearly described, appropriate, and scientific. Clearly describe and interpret results, score depends on results and perceived validity of results
Side Test Results	3	0: Less than 200 lb; 1: 200-249 lb; 2: 250-299 lb 3: 300 lb or greater
Developmental Testing		Physical testing to develop or verify design, usually conducted prior to vehicle construction
Objective	2	Clear objective for the experiment.
Methodology	2	Methodology clearly described, appropriate, and scientific.
Results and Conclusions	2	Results and conclusions stated clearly. Results should be quantitative where possible and include applicable statistical analyses (mean, standard deviation, student T test, etc.
Design Modifications	2	Demonstrate how testing results used to modify or improve the design.
Comprehensiveness and Extent	2	More extensive testing should result in more points. 0 -- only one test documented, 2 -- Multiple, but not extensive testing, 3 -- Extensive use of developmental testing.
Performance Testing		Physical testing to evaluate and optimize performance.
Objective	2	Clear objective for the experiment.
Methodology	2	Methodology clearly described, appropriate, and scientific.
Results and Conclusions	2	Results and conclusions stated clearly. Results should be quantitative where possible and include applicable statistical analyses (mean, standard deviation, student T test, etc.
Design Modifications	2	Demonstrate how testing results used to improve vehicle performance
Comprehensiveness and Extent	2	More extensive testing should result in more points. 0 -- only one test documented, 2 -- Multiple, but not extensive testing, 3 -- Extensive use of performance testing.
Comparison with PDS and Analysis	2	Test results clearly compared with analysis results and product design specifications
Discretionary Points	3	

## Safety

### 20 Evaluated primarily during static inspection and safety inspection

#### Rollover/Side Protection System

Installation & Design	2	Rollover/Side protection system installed and functional
Consistent with RPS rule	2	RPS design and fabrication appears consistent with rules
Seat belt	2	Seat belt installed correctly and appears to meet rules
Steering system	2	No excessive play or looseness, correct installation, etc.
Sharp Edges	2	No sharp edges on frame, components or fairing
Open tube ends	2	No open tube ends
Pinch Points	2	No hazardous pinch points, especially near spoked wheels, chains, sprockets, etc.
Other hazards	2	No other obvious hazards
Rider's Field of view	2	Rider should have more than 180 degrees of visibility.
Design for safety items	2	Demonstrate that safety features in addition to those prescribed have been included during vehicle design.

## Aesthetics

### 10 Evaluated at Static Inspection

Overall impression of vehicle	2	Overall impression
Quality of craftsmanship	2	Craftsmanship (welds, joints, fairing, etc) is professional and attractive.
Quality of custom parts	2	Team-fabricated and custom parts look professional and of high quality.
Paint	2	Paint quality is neat, attractive, and professional (frame and/or fairing).
Quality of assembly	2	Component and fairing assembly is professional and appears sufficiently rugged and robust for the vehicle's mission.

<b>Practicality</b>	<b>45</b>	<b>Items 1-4 evaluated based on report Items 5-10 evaluated during static inspection</b>
Objective	2	Clearly state vehicle objective with respect to practicality, e.g. weather protection, ease of transport (foldable), etc.
Define region	2	Clearly define region of country, possibly including specific city or county.
Region info	2	Summary of regional data including monthly average temperatures, snow and rainfall, winds, daylight hours, urban/rural mix, public transportation, etc.
Conditions		0: No lights or reflectors 1: Headlight installed, but not fully legal for night riding 2: Fully legal for night riding in design region (generally requires at least a headlight and rear and side reflectors, but see local laws)
Hours per Day (Ridable hours per day in region)	2	Number of ridable days per year in design region, based on temperature. This is the number of days that the cockpit temperature are between 5° C and 35°C (heaters may be installed for cold climates to extend range) 0: Less than 180 days; 1: 180 to 320 days; 2: >320 days
Thermal days per year	2	Number of ridable days per year in design region, based on weather. Vehicle is considered unridable in snow, ice and slush, and rain unless the team convincingly demonstrates these capabilities. 0: Less than 180 days; 1: 180 to 320 days; 2: >320 days
Weather days per year	2	Team must provide evidence of long-term serviceability in corrosive environments -- salt (winter weather, coastal regions, sandy regions, etc.)
Corrosion resistance	2	Demonstrate that maintenance service intervals are minimal.
Maintainence		
Visibility		
Driver's field of view	2	Driver can clearly see to the front, side and rear of vehicle.
Visibility to others	2	Vehicle is clearly visible to others while in operation.
Special Features		
Fodable or collapsable	2	Vehicle folds or breaks down for transport and/or storage
Free standing	2	Vehicle does not require external stand to prevent falling while parked
Energy storage/regenerative braking	2	Demonstrate functional energy storage and/or regenerative braking system.
Additional special features	2	Demonstrate the effective design of additional practicality features such as heaters, windheild wipers, etc. Up to 2 points per additional feature.
Utility Features		
Headlight	1	Headlight present and operational.
Taillight	1	Taillight present and operational.
Bell	1	Bell present and operational.
Side reflectors	1	Amber side reflectors present and operational.
Rear reflector	1	Red rear reflectors present and operational.
Theft protection (lock)	1	Lock or theft protection system present and operational.
Mudguards or spray protection	1	Spray protection or mudguards present and operational.

Cargo area/luggage rack	1	Go/No Go cargo test passed.
Physical Characteristics		
Weight	2	Single rider vehicles: 0: > 30 kg; 1: 18-30 kg; 2 < 18 kg Multi rider vehicles: multiply by 1.5*number riders
Width	2	0: > 1.25 m; 1: .75-1.25 m; 2: < .75 m
Ingress/Egress Ease	2	Ease with which driver enters/exits vehicle, including any doors, etc.
Vehicle meets objective	2	Overall vehicle meets utility objective for specified region
Discretionary points	3	