World Human Powered Vehicle Association

Competition Rules

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1.0 PURPOSE:

The World Human Powered Vehicle Association (WHPVA) supports human-powered vehicle competition and ratifies and maintains performance records for the purpose of promoting advancements in human-power technology.

2.0 GENERAL:

These rules apply to human-powered vehicle competition in three categories:

1. Land
2. Water
3. Air

Within these categories, records are maintained in the classes of competition outlined below. The WHPVA ratifies and maintains records but assumes no responsibility for the attempts themselves. Observation and verification of record attempts is the responsibility of WHPVA member organisations.

3.0 LAND VEHICLE COMPETITIONS

3.1 Vehicle Requirements

3.1.1 Power: Vehicles must be driven solely by human power. Non-human power sources (batteries, solar cells, etc.) are permitted only for powering sensors, displays, communication equipment, electric gear shifters and lights. Control devices, cooling fans, powered aerodynamic devices, etc., may not be powered from non-human sources.

3.1.2 Energy Storage: No device which stores energy over more than one input power cycle (e.g., one leg stroke), or which releases energy under control of the operator, may be used in any event except the road race, or speed events longer than one mile. Energy storage devices are permitted in these events provided no energy is stored before the start of the event. This means absolutely no chemical, electrical, kinetic, potential, or other form of energy storage at the start. This includes phase-change vests or ice packs. The use of spray water bottles with ambient temperature water is accepted.

3.1.3 Brakes: All vehicles must have a safe means of stopping.

3.1.4 Control: All vehicles must be controlled by the rider(s), with the single exception of that necessitated by the standing start as described in section 3.2.3.1.

3.1.5 Integrity: No vehicle may discard any part after beginning motion.

3.1.6 Geometry: The vehicle geometry may not be alterable during use except for steering purposes; i.e. sails or moving control surfaces specifically intended to enhance the sailing characteristics of the vehicle are not permitted.

3.1.7 Vehicle Classes: Vehicles shall be recognised in the following classes:

3.1.7.1 Open: Any human powered land vehicle.

3.1.7.2 Restricted or Part-faired: To be defined.

3.2 Events

3.2.1 Competition Classes: Competition events shall be recognised in the following classes:

3.2.1.1 Single Rider: Only one person.

3.2.1.2 Multiple rider: Two or more persons.

3.2.1.3 Arms only: Competitors may use arms only power in all WHPVA events; land, water and air. It will be deemed a separate event category if the rules in section 3.4 "Arm Power Rules" are met. Event officials may request separate arm power events for safety or practical purposes.

3.2.1.3.1 Physically handicapped riders: Rules to be determined. Event Directors may institute special competitions in this area.

3.2.1.4 Male and female riders: The WHPVA shall recognise separate records for males and females in all events.

3.2.1.5 Organiser's option: Classes may be combined by the event organiser for a single race, but all records will be maintained in the classes indicated.

3.2.1.6 Altitude: The WHPVA recognizes land speed records divided into high and low altitude classes. The division between high and low is at 700 meters above sea level.

3.2.1.7: Pure Human Power Class: The WHPVA recognizes land speed records in traditional classes and where applicable in pure human power classes as defined in rule 3.3.1.

3.2.2 Types of Events: The following race events are recognised:

3.2.2.1 200 Metre Speed Trial: The winner of this event shall be the vehicle achieving the highest average speed over a 200 metre interval. A flying start from any distance is permitted, within practical limits as established by the event organiser.

3.2.2.2 200 Metre Speed Trial, 600 metre start: Highest average speed over a 200 metre interval. Flying start from not more than 600 metres before the 200

metre timed section.

3.2.2.3 500 Metre Speed Trial: Identical to 3.2.2.1 except 500 metres.

3.2.2.4 1 Kilometre Speed Trial: Identical to 3.2.2.1 except 1 kilometre.

3.2.2.4.1 1 Kilometre Speed Trial: Identical to 3.2.2.4 except standing start.

3.2.2.5 4 Kilometre Speed Trial: Identical to 3.2.2.1 except 4 kilometres and standing start.

3.2.2.6 10 Kilometre Speed Trial: Identical to 3.2.2.1 except 10 kilometres and standing start.

3.2.2.7 100 Kilometre Speed Trial: Identical to 3.2.2.1 except 100 kilometres and standing start.

3.2.2.8 1 Mega-Metre (1,000,000 metres) Speed Trial: Identical to 3.2.2.1 except 1,000,000 metres and standing start.

3.2.2.9 1 Mile Speed Trial: Identical to 3.2.2.1 except 1 mile.

3.2.2.10 1/4 Mile Elapsed Time: Shortest elapsed time to travel 1/4 mile. Standing start.

3.2.2.11 1-Hour Time Trial: Maximum distance in one hour. Closed course. Standing start. Distance is determined by direct measurement. Alternatively, the time trial distance may be calculated from the course length and lap timings.

3.2.2.12 1-Hour Time Trial, Velodrome: Maximum distance in one hour on closed course of maximum 500m length. Standing start. Distance is determined by direct measurement. Alternatively, the time trial distance may be calculated from the course length and lap timings.

3.2.2.13 6-Hour Time Trial: Same as 3.2.2.11 except 6 hours

3.2.2.14 12-Hour Time Trial: Same as 3.2.2.11 except 12 hours.

3.2.2.15 24-Hour Time Trial: Same as 3.2.2.11 except 24 hours.

3.2.2.16 Road Race: Winner is the vehicle to first complete a designated number of laps on a designated course, or travel the longest distance within a designated time period. Standing start, flying start or LeMans start. No records shall be recognised for this event.

3.2.2.17 Practical/Commuter Vehicle: Rules to be determined.

3.2.2.18 Special Records Events: Members are encouraged to submit applications for new record categories to the WHPVA. Significant achievements may be

recognised as new record classes.

3.2.3 Starts

3.2.3.1 Standing Start: A standing start is an unassisted start from the stationary position, except that vehicles which are unstable at low speeds may be assisted by one assistant and optional technical support gear for not more than 15 metres. The assistant may not push the vehicle.

3.2.3.2 Flying Start: A flying start is where the vehicle may accelerate before entering the timed portion of the course. Push assists by one or more persons are permitted. Pushers may not assist the vehicle for more than 15 metres.

3.2.3.3 LeMans Start: A LeMans start is where the vehicles are parked diagonally on one side of the race course, while the riders line up on the other side of the track. At the start of the race, the riders run to their vehicles, get in, and proceed onto the course. Push assists are not permitted. However, if any vehicle is unstable at low speeds, a single assistant is permitted to stabilise the vehicle for not more than 15 metres. The same assistant may also assist the rider in getting into the vehicle, closing canopies, etc.

3.2.4 Drafting: No human-powered vehicle may be assisted in any record attempt by a pacing vehicle used for the purpose of aerodynamic assistance.

3.2.5 Change of Riders: No change of riders or removal of riders is permitted during a race.

3.2.6 Passing: In multiple-vehicle races, lapped vehicles must yield right-of-way to lapping vehicles. Blocking or obstructing the race path by weaving is prohibited. Vehicles should follow a steady predictable line during a race and avoid sudden manoeuvres which might cause accidents.

3.2.7 Safety Requirements

3.2.7.1 Helmets: All riders shall wear helmets during all competition. Helmets must meet the standards of a nationally accredited testing facility.

3.2.7.2 Vehicle Safety: Vehicles may be disqualified from competition due to inadequate braking capability, lack of stability, poor visibility, presence of dangerous protrusions, or other unsafe design features.

3.2.8 Conduct: Any competitor judged by the event organiser(s) to be riding without regard for the safety of others or deliberately obstructing other competitors may be disqualified from that particular event.
Any competitor or team found to have carried out intimidations, threats or assaults against anybody will automatically be disqualified from that particular event and may additionally be disqualified from further record attempts for up to 12 months.

3.2.9 Illegal Substances: The competitor may be subject to tests for drugs or

other substances designed to enhance athletic performance that may be defined as illegal by the International Olympic Committee at the time of the attempt. Detection of illegal substances will invalidate the attempt.

3.3 COURSE REQUIREMENTS

3.3.1 Course Flatness and Straightness: Except for courses for the road race events, time trial events one hour and over, and the pure human power class, all courses must meet the following flatness requirement: If an imaginary line is drawn from the end of the timed portion of the event course back toward the beginning of the course but sloped upward at a slope of 2/3 percent (1 metre in 150), at no point may the vehicle course pass above this line. Curved courses may be used for any event, provided the same flatness requirement is met. The 200 metre time trap in the 200 metre speed trial events, however, must be contained in a straight section. All curved courses must be clearly marked with the limiting inside boundary. Any vehicle crossing a wheel over this boundary shall be disqualified from the run. Course distance shall be measured from the inside boundary of turns.
Pure Human Power Class: All courses must be sufficiently flat to give no speed advantage compared to the otherwise same situation on a hypothetical course with constant elevation. One case with which this is fulfilled is when all points of a timed section have an elevation which is equal to or higher than that of its start, and all points of a run-up section have an elevation which is equal to or lower than that of its finish. See Appendix D for explanations.

3.3.2 Course Measurement: In order to qualify as a record course, distances and elevation difference must be measured and certified by a registered Civil Engineer, a registered Land Surveyor, or a person with equivalent training.

3.3.3 Timing: All timing must be accomplished by automatic start and stop actuation. Timers must be certified as accurate to within 1/100 of a second in 10 minutes or 1 second per day at a temperature of 20 degrees/C, plus or minus 5 degrees/C. Certification must be by a chronographic testing service or a registered Electrical Engineer. Timing to the nearest 1/100 second is required, and timing to the nearest 1/1000 second is preferred.

3.3.4 Wind: For any run to be approved as a record, except as noted in section 3.3.4.1 below, the wind velocity in any direction must not exceed 6 (six) kilometres per hour (1.67 metres per second). Wind velocity measurement must be taken during the duration of the actual timed run at the finish of the course, at a level of 2 metres above the course surface. These restrictions apply to closed and straight courses.

3.3.4.1 Wind Restrictions for Long Duration Events: There are no wind restrictions for time trial events of one hour or longer, or for distance events of 100 km or greater, provided the event is held on a close course, at least one full lap is completed, and the impact of up- and downwind portions of the track is balanced. The geometry of vehicles competing under this rule shall be fixed: there will be no sails or moving control surfaces specifically intended to enhance the sailing characteristics of the vehicle.

3.4 ARM POWER RULES

3.4.1 Power: Power from the rider(s) to vehicle momentum shall be transmitted

by way of rider(s) arm and hand movements only. Upper torso above hips may contribute such power output. No part of a rider's leg or foot shall contribute to upper body power output for gaining and maintaining vehicle momentum.

3.4.2 Control: No restrictions, but must meet all WHPVA vehicle control requirements as set forth in general rules.

3.4.3 Qualification: Any rider may compete in arms only events provided they meet all arm power rules.

3.5 DOCUMENTATION -Written documentation of a record attempt must be submitted to the sanctioning WHPVA Member Organisation within 30 days after the attempt. This shall include:

- The date, time and location of the attempt.
- The names of the vehicle designer(s), builder(s), and rider(s) and the name(s) of the person(s) or organisation(s) applying for the record.
- Photographs of the vehicle, or acceptable drawings.
- Evidence of timer calibration and accuracy.
- Evidence of course measurement and accuracy.
- A statement that all of these regulations and conditions have been complied with, signed by the applicant and both observers.
- A record of the environmental conditions during the whole attempt.
- Speed and direction of wind
- A videotape showing the attempt, starting procedure and compliance with these regulations and conditions is highly recommended.

See also WHPVA OBSERVER GUIDELINES.

4.0 WATER VEHICLE COMPETITION RULES:

4.1 VEHICLE REQUIREMENTS (PURE HUMAN POWER CLASS)

4.1.1 Power: Vehicles must be driven solely by self-contained human power. Non-human power sources (batteries, solar cells, etc.) are permitted only for powering sensors, displays, communication equipment, or lights. Control devices, cooling fans, aerodynamic and hydrodynamic devices must be human powered. Some exceptions may be allowed, but must be approved in advance of any attempt by the WHPVA Records Committee. Power may not be extracted from wave energy or wind and water currents, except momentarily in such a way that the overall effect during the attempt does not constitute an advantage when compared to the same attempt without these conditions, or within the tolerances specified in Appendix B.

4.1.2 Energy Storage: In events with a flying start the accumulation of the kinetic energy of vehicle and rider(s) is permitted in accordance with rule 4.2.3.2. Other forms of energy storage are permitted provided this energy is created within the timing section of an attempt and provided its source is human power. No pre-start storage is allowed. See Appendix B and also rule 4.1.1 regarding instrument batteries.

4.1.3 Propulsion: Propulsion must be provided entirely by hydrodynamic and/or aerodynamic devices. Any type of fluid-dynamic propulsion device is allowed. Particular characterisations of propulsion, e.g. oars, propellers, paddle wheels, or those not

covered by these rules (e.g. punting) may be divided into separate sub-classes. Riders may use any and all parts of their bodies for propulsion (except for the 'Arms Only' class defined in rule section 4.2.2.3.)

4.1.4 Control: Vehicle control forces must be provided by onboard rider-controlled mechanical, hydrodynamic, or aerodynamic device(s). The onboard rider(s) must control the vehicle; other person(s) or means must not control the vehicle. Auto-steering devices under the direct control of the rider are permitted.

4.1.5 Integrity: No materials may be jettisoned for aiding propulsion or lightening the craft other than unadulterated water or air collected during the attempt. The rider must ride on or in the vehicle.

4.1.6 Support: All types of devices directly or indirectly supported by the water are allowed. This includes displacement and planing craft, hydrofoils, hovercraft, and craft having moving skins or tracks. Vehicles using an "air cushion" or "ground effect" are permitted, whereas craft capable of free flying are not. Records characterised by the type of support, e.g. displacement craft, or underwater craft, are considered sub-classes (see 4.2.1.2). The rider(s) and vehicle must be able to begin and end any attempt fully afloat and essentially stationary with respect to the water. For the passage through the timing section itself, see 4.2.3.

4.1.7 Rider Attributes: Any number of active riders of either gender may power the vehicle. The gender and number of riders constitute a class distinction, e.g. single-rider, women. Those who request a class distinction for other physical attributes: youth, senior, physical size, physical disability, etc. may request such distinction from the WHPVA Records Committee. Approval must be completed prior to any record attempt.

4.2 WATERCRAFT CLASS EVENTS

4.2.1 COMPETITION CLASSES: A complete list of watercraft classes maintained, and events within those classes, are shown in Appendix A. The WHPVA web site at http://www.WHPVA.org may contain updated Appendix information. The following class types are recognised for events:

4.2.1.1 Pure Human Power Class: Watercraft must meet the requirements as defined in section 4.1 to be automatically recognised as such.

4.2.1.2 Sub-Classes: Classes that do not meet the requirements of the Pure Human Power Class as defined in section 4.1 are called sub-classes. The WHPVA may record or publish achievements in sub-classes that are regarded as worthwhile. The rules governing sub-classes are the same as for the watercraft Pure Human Power Class with the exception of the particularities in question. The sub-class must be qualified by these particularities, if possible within its name.

4.2.1.3 Other Achievements in Watercraft: A record attempt, which nearly fits into an existing class but does not fulfil all requirements, may be recognised as an "outstanding achievement" or "qualified record" within the existing class, provided that the particularity of the attempt is clearly recognisable. An "outstanding achievement" or "qualified record" within an existing class may include class records maintained by other organisations.

4.2.1.4 New Classes: New classes may be started at any time but will not necessarily be maintained or published by the WHPVA until added to the class list by the WHPVA Records Committee at its discretion.

4.2.2 CLASS CATEGORIES: For the purpose of event records within the watercraft Pure Human Power Class, the following categories shall be recognised (class categories in Sub-Classes must be separately approved. See Appendix A):

4.2.2.1 Single Rider: The vehicle shall contain only one person.

4.2.2.2 Multiple Riders: The vehicle shall contain two or more persons. Multi-rider classes may be gender mixed.

4.2.2.3 Arms Only Riders: Deemed a separate category when following rules are met:

4.2.2.3.1 Power: Power from the rider(s) to vehicle momentum shall be transmitted by way of rider(s) arm and hand movements only. Upper torso above the hips may contribute to arm and hand power output. No part of a riders leg or foot shall contribute to upper body power output for gaining and maintaining vehicle momentum.

4.2.2.3.2 Control: No additional restrictions, but must meet all WHPVA vehicle control requirements as set forth in the watercraft rules.

4.2.2.3.3 Qualification: Any riders may compete in arms only events provided they meet all power rules. Riders who have disabilities that prevent them from meeting all requirements of section 4.2.2.3 may request a waiver from the WHPVA Records Committee (in advance of attempt) so they may legally compete in this category. However, such request will not be granted if doing so would give the rider(s) a significant competitive advantage over others in this class.

4.2.2.4 Male and Female Riders: The WHPVA shall recognise separate records for male and female riders in events. Multi-rider vehicles with both male and female riders shall have no class distinction based on gender.

4.2.3 STARTING AND FINISHING

4.2.3.1 Standing Start: The rider(s) and vehicle must be at rest and fully afloat behind the starting line when the event timing starts.

4.2.3.2 Flying Start: The vehicle may accelerate over an unlimited distance prior to entering the timed portion of the course. All watercraft momentum gained prior to the timing section must be made by human powered efforts of the rider(s) as required in other sections of these rules.

4.2.3.3 Finishing: Finishes may always be timed "flying", i.e. with the vehicle moving.

4.2.4 DRAFTING: A vehicle may not be aerodynamically or hydrodynamically assisted by the presence or action of any other vehicle or device. It is accepted that

passing vehicles may momentarily cause assistance (see section 4.2.6.)

4.2.5 CHANGE OF RIDERS: No change of rider(s) or removal of rider(s) is permitted during an event. Rider(s) may remove themselves for reason of illness or emergency and the record attempt continued if this does not result in an advantage over the normal situation. Records with defined rider changes are possible under appropriate sub-classes.

4.2.6 PASSING: In events where multiple vehicles are on a course at the same time, vehicles being overtaken from behind, such as being lapped, may not obstruct the path of others on course by weaving or deliberate obstruction of the course. Vehicles should follow a steady predictable line during an event and avoid sudden manoeuvres that might cause accidents. Event observers shall make judgements on passing disputes.

4.2.7 SAFETY REQUIREMENTS: Safety shall be paramount at all times and is the responsibility of the entrant. The observers must be satisfied that the course is safe; attempts will not be observed under unsafe course conditions or if the the competitors create unsafe conditions through their behaviour or riding style.

4.2.7.1 Personal Flotation Devices: Riders must in general carry one Personal Flotation Device (sometimes known as "life vests") on board for each person and wear them as instructed by the observers or event organiser. This requirement may be waived in closely supervised attempts or if equivalent buoyancy aids are worn. Riders are required to keep their own safety in mind and wear their life vests if there is a reason to, such as bad weather, cold water, known weaknesses of craft or rider(s), or not being able to swim. The standard and use of the flotation device must meet local legislative requirements and should reflect the conditions. People, craft, or courses with special risks should warrant the use of appropriate flotation devices and not just buoyancy aids.

4.2.7.2 Buoyancy: The vehicle must be buoyant under normal event conditions or when capsized. The event organiser may waive this requirement if they supervise each attempt closely and provide for the safety of the rider(s) and for any required recovery of the craft(s).

4.2.7.3 Additional Safety Requirements: The observers must be satisfied that the rider can exit the vehicle unassisted and has effective protection from injuries. Official observers may require additional safety equipment such as paddle(s), bailer, line, whistle, and flag. Safety equipment should be agreed upon in advance of attempt. For long distance events in open waters, additional pyrotechnic and radio means are recommended.

4.2.8 CONDUCT: In the case of record attempts carried out during race meetings or similar events, any competitor judged by the event organiser to have misbehaved during an event may be disqualified from that particular event.

4.2.9 ILLEGAL SUBSTANCES: The competitor may be subject to tests for drugs or other substances designed to enhance athletic performance that may be defined as illegal by the International Olympic Committee at the time of the attempt. Detection of illegal substances will invalidate the attempt.

4.3 WATERCRAFT COURSE REQUIREMENTS

4.3.1 COURSE LAYOUT: The course shall be defined as the shortest possible path between the start and finish line, which may include markers that must be passed in a specified manner. A speed measurement shall be made by measuring the elapsed time over the specified distance.

4.3.2 COURSE MEASUREMENT: The distance of a course shall be measured and certified by a registered Civil Engineer, licensed Surveyor, or equivalent. Markers establishing the distance must be firmly attached to the earth, either on shore, on driven piles or by other means not subject to drift due to current or wind. The start/stop actuators or transits for timing shall be located at these positions. The measurement error must be indicated and the course lengthened by at least this error, i.e. if the measurement error is 0.1 m, the nominal 100 m course must be laid out as 100.1 m, but 100.0 m used in any further calculations for speed.

4.3.3 COURSE DEFINITION: Courses can have the same or different start and end points, but must be continuously measured, i.e. it is not permissible to consider the average of a number of runs as a record.

4.3.4 ENVIRONMENTAL FACTORS: It must be proved plausibly that there is no net environmental power input or advantage due to potential energy difference during the attempt except for the allowable tolerances. Ways of establishing this and the currently allowable tolerances are described in Appendix B. Vehicles which do use environmental energy over the tolerated amount are considered in a sub-class of environmentally-assisted vehicles. There are no restrictions regarding altitude.

4.3.5 WATER: The water must be liquid (no ice boats) and be of a temperature and salinity as found in natural bodies of water. The depth must be sufficient that no support is derived directly or indirectly by the bottom. See Appendix B.

4.3.6 TIMING: Timing equipment must have a resolution of at least 0.1 s except for long distance events where 1 second is sufficient. Timing results must be rounded in the unfavourable direction or accepted statistical methods applied (and documented) in the case of multiple timing devices. Methods such as Video-Timing or Global Satellite Positioning are allowed if it can be shown that they are suitable, sufficiently accurate, and calibrated. Videotape documentation of events is highly recommended; see section 4.4.

4.4 DOCUMENTATION -Written documentation of a record attempt must be submitted to the WHPVA within 30 days after the attempt. This shall include:

- The date, time and location of the attempt.
- The names of the watercraft designer(s), builder(s), and rider(s) and the name(s) of the person(s) or organisation(s) applying for the record.
- Photographs of the vehicle, or acceptable drawings.
- Evidence of timer calibration and accuracy.
- Evidence of course measurement and accuracy.
- A statement that all of these regulations and conditions have been complied with, signed by the applicant and both observers.
- A record of the environmental conditions during the whole attempt:
- Speed and direction of wind

• Speed and direction of water current(s)
• Water conditions (sea state and type of water body, water depth if relevant. See Appendix B)
• A videotape showing the attempt, starting procedure and compliance with these regulations and conditions is highly recommended.

5.0 AIR VEHICLE COMPETITION RULES: To be determined.

6.0 OBSERVERS:

All record attempts must be sanctioned by an WHPVA member organisation and witnessed by at least two observers appointed by the sanctioning organisation. Observers should be independent of the competing team and qualified by training or experience for observation. The responsibility of observers is to establish that WHPVA Competition Rules have been followed for an attempt, record all information relevant to the attempt, and provide the sanctioning national organisation with an Observers' Report.

7.0 RATIFICATION:

The WHPVA will ratify record performances organised under these rules. In order for a record to be ratified, the sanctioning national organisation must file a request for ratification together with the completed Observers' Report for the attempt, with the WHPVA Record Committee within 45 days of the event.

At least one member of the competing team must be a current member of an WHPVA member organisation.

8.0 ALL COMERS RECORDS

Records will be recognised on a national basis, and by general geographic area, such as Europe, North America, Africa, etc. The best performance in a given country or general area shall be the All Comers Record, regardless of the nationality of rider or machine. The best performance between All Comers Records in different countries shall be the World Record.

9.0 RULES CHANGES:
Any member of an WHPVA member association may recommend a change of rule to the WHPVA Board.

Appendix A

WHPVA Watercraft Classes and Events

• 100 metre flying start speed trial -Men, single rider
• 100 metre flying start speed trial -Women, single rider
• 2,000 metre standing start speed trial -Men, single rider
• 12 hour standing start speed trial -Men, multiple rider
• 12 hour standing start speed trial -Women, multiple rider

- 24 hour standing start speed trial -Men, single rider
- 24 hour standing start speed trial -Multiple riders

Appendix B

WHPVA Watercraft Environmental Tolerances and examples

Wind and Current: Attempts may be disallowed if observation notes show that wind or water currents may have contributed to an improved average course speed (inclusive of flying start run-ups) when compared with a hypothetical no-wind or no-current situation. Favourable winds and currents which result in a speed advantage of less than 1% may be tolerated if this can be adequately and accurately shown.

Measurement errors must be specified except in cases where it is clear that even large errors have no relevance.

Examples (these are not rules, but suggestions for showing their fulfilment):

Water currents:

Water surface current can easily be measured by timing and sighting a floating orange. Except near the inflow and outflow of rivers, the water current in lakes is usually negligible except for the wind-induced surface current.

Wind:

Wind strength can be measured by a variety of instruments either instantaneously or by averaging during the duration of the attempt. Accuracy is not important as long as it can be shown that there is no net power gain. For example with unstreamlined vehicles, if there is a favourable gust this can be discounted if there is at least an unfavourable gust from the opposite direction with at least the same duration.

Wind direction can be measured instantaneously by a number of devices: wind vanes, streamers, smoke, or soap bubbles. The wind direction can be considered constant if it varies only slightly during the attempt in the experience of the observers, otherwise the deviations must be recorded.

Streamers such as a simple woollen thread, smoke, etc. are extremely sensitive and can show very low wind strengths and their direction. Some axial vane devices are very sensitive and if set up in the direction of the run will count both forward and backward, thus immediately showing the average wind component strength and direction. A negative (i.e. headwind) count is sufficient evidence to prove no wind assistance at the location of the instrument provided that the true wind direction is shown to be at an angle of less than 45 degrees for completely unstreamlined craft and less than 10 degrees for highly streamlined craft or craft using air propellers. In cases of doubt it is suggested to gather sufficient measurements for the record committee to decide.

General:

What counts is the experience, integrity, and common sense of the observers. Clearly, a

round-course will not cancel environmental effects if currents and winds are non-uniform and happen to coincide favourably with the course, e.g. a large eddy in the same direction, or an exposed downwind leg and a sheltered upwind leg. Equally, any craft with the least sailing capabilities will gain most by travelling at right angles to the wind. Or, any craft with both air and water propellers will be capable of exploiting slight differences in wind or current in any direction.

Appendix C

Electric gear shifter brands (rule 3.1.1)

Examples for admissible brands of electric gear shifters are: Shimano Di2, Campagnolo Record EPS and SRAM RED eTap.

Appendix D

WHPVA Land Vehicle Environmental Explanations for Pure Human Power Class

Gravity:
Rule 3.3.1 implies that the potential energy of a vehicle and rider(s) (total weight x elevation) at the start of a course may vary along the course but not be of a lower value at the finish. Timed sections may contain a positive variation of potential energy (hills) and run-up sections may contain negative variations (valleys), of any magnitude, but not vice-versa. This is because such variations represent no advantage compared to a perfect course of equal elevation. See the WHPVA website for more information. Small variations to this principle could be tolerated if it could be clearly shown that they have no advantageous effect.

Determining Elevations:
The relative elevations of the starts and finishes of course sections should be determined as accurately as possible, the error given and applied in the disadvantageous direction. Except when it is clear to all observers, for instance by sighting along short straight-line courses, and affirmed by them that there are no valleys in timed sections or hills in run-up sections, an elevation profile should be drawn in order to show that the required conditions are met, again with measurement errors given and applied in the disadvantageous direction. The resolution and accuracy of the profile need not be greater than necessary to show the fulfillment of the requirements.

END