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Submitted by:

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1. INTRODUCTION TO TEST PROJECT DOCUMENTATION

PROJECT BRIEF

A growing area in the commercial market is in personal transport. A vehicle capable of moving a single person around an urban environment to aid with commuting, shopping or just for leisure. The humble Bicycle has seen a transformation into the E-Bike, skateboards have been given motors and a huge variety of solutions are now available. Even a record-breaking Jet powered Hoverboard capable of flying 10,000 feet above the ground now exists and who could forget the two wheeled hoverboards that don't hover?

There are versions of personal transport systems available with seats for the user to sit on and versions where the user remains standing, for this brief either option or in fact any other option is for the team to choose.

2. DESCRIPTION OF PROJECT AND TASKS

2.1. MAIN PROJECT

The project is open for you to create and innovate as much as you are able. The system must simply be easy to use. The system for personal transport developed must fit a range of users for maximum sales revenue and should not be sized for one person, but for a range of adults of all sizes and shapes in one saleable product.
The system should be suitable for use in an urban environment and therefore be able to negotiate curbs, uneven floors, flagged and gravel surfaces as found in most towns and cities. The system will need to be able to easily aid in commuting which may involve travel to and from public transport at both end of the journey, for example a 1 Km trip to an underground station, underground station to place of work, 1 Km, making 2 Km to work and a return journey of another 2 Km. Therefore, the system should be capable of travelling at least 4 Km on a single charge.
The system also needs to convey its user faster than walking would allow to speed up the journey and make the commute easier and quicker for the user. This would form a good purchasing point for the purchaser.
The system must fit in a Backpack.

2.2. MATERIALS AND PRODUCTION COSTS

The cost of Main Project materials, together with working hours and the cost of hiring equipment during the competition will be calculated. These costs will be set against a teams' compliance in the Main Project to generate an actual cost, from which marks will be awarded proportional to each teams' performance in the competition. The time used for manufacturing the Surprise Projects will also be considered.
During the competition, the Experts have no control over the time used for both the Main Project and Surprise Project, therefore, the teams have control over their manufacturing schedule and are expected to perform all tasks at any time to suit; Experts will only consider the total time used.

3. INSTRUCTIONS TO THE COMPETITOR

3.1. COMPETITION REQUIREMENTS

Each team will provide at the event:

- ✓ 1 (one), personal transport system suitable for a commuter.

3.2. ACTIVITIES TO BE COMPLETED BEFORE THE COMPETITION

- ✓ Section A of the portfolio;
- ✓ Purchase of all permissible raw materials, components and fasteners needed by the team to manufacture their Main Project;
- ✓ Materials may be rough cut into billets, or length but may not be machined to size. Burrs or sharp edges are to be removed. 50mm oversized in one direction for all length materials and in two directions for all sheet materials;
- ✓ Manufacture of electronic circuit boards, but these boards may not have components mounted before the Competition.

Note: Purchased items/components are not to be modified in any way prior to the Competition. Subject to penalty with withdrawal of item or additional time on team or increase in item cost.

3.3. ACTIVITIES TO BE ATTEMPTED DURING THE COMPETITION

- ✓ Manufacturing of all components of the personal transport system;
- ✓ Electrical/electronic assembly – all individual components must be assembled, and all PLC and/or microchips must be programmed during the Competition;
- ✓ Mechanical assembly of complete personal transport system;
- ✓ Testing of personal transport system;

4. EQUIPMENT, MACHINERY, INSTALLATIONS AND MATERIALS REQUIRED

4.1. EQUIPMENT AND MATERIALS NOT PERMITTED

- ✓ Laptop or portable computers.
- ✓ PDA's e.g. Palm, IPAQ etc.
- ✓ Memory sticks/MP3 Player/Digital Storage.
- ✓ Walkman radio/CD Player.
- ✓ Electronic organizer/diaries.
- ✓ Wireless communication devices.
- ✓ None approved CDs or floppy discs – approval by Experts or delegate is required for all CDs and floppy discs.
- ✓ Any additional software not supplied by organizers unless approved by Experts
- ✓ Pre-programmed IC's.
- ✓ Purchased items modified in any way prior to the Competition.
- ✓ All subassemblies for the personal transport system mechanisms.
- ✓ Equipment that is similar or operates in similar manner as supplied equipment. Example – if a metal cut-off saw is provided by organizers, then no team may provide their own metal cut-off saw.
- ✓ All raw materials, components, parts, purchased item, tools and equipment not permitted in the Technical Description and List of Materials Allowed and Not Allowed of the skill.

4.2. ITEMS TO BE PROVIDED BY TEAMS

Each team must provide and wear team identification (e.g. coloured shirt) or armbands that indicate their team. These must be worn at all times during the Competition. It is the responsibility of the team to supply all the components and raw materials to manufacture the personal transport system. This may include but is not limited to the following items:

- ✓ Electrical motors. (Electrical motors connectors will be cut on the familiarization day).
- ✓ Battery/batteries.
- ✓ Electronic circuit board – not mounted (circuit board components must be assembled on the board at the Competition).
- ✓ All Electrical and electronic components.
- ✓ Electric cables, connectors and couplings. Readymade cables with connector are not permitted. All connector must be fitted during the competition.
- ✓ Jigs, fixtures, formers and clamping devices.
- ✓ All materials with which to construct the personal transport system and all other associated equipment and consumables (sheet metal, screws, nuts, pins, pegs, etc.).
- ✓ All personal protective equipment.
- ✓ Standard tooling kit as described in the MTC Technical Description.
- ✓ Other specific manufacturing equipment or tools required that is not in the infrastructure list.
- ✓ Bearings (unmodified).
- ✓ Sprockets, pulleys, gears, couplings, chain and belts (as supplied and must not be altered). Catalogue or standard must be provided.
- ✓ Hydraulic or pneumatic components and fittings not assembled.
- ✓ During the competition duration, no tools, equipment, stationary, components, part, raw materials, manuals, drawings, electrical device or digital storage device, unless approved by the Chief Expert may be removed from or brought into the competition venue. To enter items in the competition, the approval of the Chief Expert is first necessary*, and if approved, it must be weighed immediately by the responsible Experts.*

5. MAIN PROJECT

5.1. WORK QUALITY AND VISUAL APPEARANCE (3 MARKS)

Each personal transport system is observed to see whether its quality and appearance satisfy industrial requirements.

Marks per Aspect:

Maximum Marks: 3

The personal transport system will be evaluated according to the scoring scale from 0 to 3. Considering scale 3 for a personal transport system that is above market standards, and "0" scale for personal transport system that is below market standards. The score from 0 to 2 will be proportional to the average score achieved on the judgement scale of 0 to 3.

Evaluation process:

Before the Team signs off from their activities the personal transport system must be submitted for inspection to the Expert team responsible for Judging the Work Quality and Visual Appearance. This team will be made clear to all competitors prior to competition start.
The judgment evaluation process applies to scoring.
The team of three Experts will evaluate the Project. This will not include an Expert that is associated with the team.

The Experts will observe if there are visual failures and evaluate how many failures there are.
During this time the personal transport system will be presented unpacked and setup ready for use.

The judgement scale of 0 – 3 will be applied. There may be difference up to 1 point in the scale.
Scale 0: Project does not meet the market standard.
Scale 1: Satisfies the industry standard.
Scale 2: Satisfies the market standard.
Scale 3: It exceeds the Market standard.

5.2. TEAM PACKING AND UNPACKING TIME TRIAL (4 MARKS)

The team shall be challenged to unpack the personal transportations system from the Backpack and demonstrate it working. The team will then pack the personal transportation system back into the Backpack. This will be timed.

Marks per Aspect:

Maximum Marks: 4

5.2.1. Unpack, use and repack time trial (2,0 Mark)

The team with the fastest time gains, 4 Mark. The slowest time gains 0 Marks.
All other times are awarded 0 to 4,0 Marks proportionally in each category.
Note: Marks will be calculated using calculations in the CIS scoring system

Evaluation process:

The team will nominate one person who must present the personal transportation system in the Backpack at the start position. The Backpack must be on the persons back with both shoulder straps in place.
A judge will give a 3,2,1 countdown and give the command “go”.
The nominated team member will run 1 metre to the drive line.
The nominated team member will then unpack and set up the personal transportation system.

The nominated team member will then use the personal transportation system to convey him or her under power only 2,5 meters and then once past that line turn 180 degrees and drive back across to the drive line.
Once this line is crossed, he or she will pack the personal transportation system back into the back pack.
The backpack must be on the nominated team members back with both shoulder straps in place, before they can move to complete the time trial by crossing the line a further 1 meter away.
Once the line is completely crossed the time will be stopped.

5.3. WEIGHT (4 MARKS)

The personal transport system and controls complete with battery(ies) and the rucksack shall be as lightweight as possible for ease of carrying.

Marks per Aspect:
Maximum Marks: 4

5.5.1 The lightest project gains 4 Marks and the heaviest project gains 0 Marks. Other projects are scored 0 to 2 Marks proportionally according to their weights.

Evaluation process:

Each team puts the completed project, ready to use, on the weighing scale twice. The Expert reads the weight displayed by the scale each time to see that the numeric values are the same. If the values are different, the average weight is taken.
Note: The score is calculated by using the CIS scoring system.

5.4. ERGANOMIC HAND CONTROLS (3 MARKS)

The Judge shall hold the hand controls for speed. The hand controls must have an easy to press dead mans switch to cut power when released/ the hand control must have speed control that can be easily operated. The hand controls must be comfortable to hold.

Marks per Aspect:
Maximum Marks: 3

5.4.1. The controls have a dead man switch that cuts all power (1 Marks)
5.4.2. The controls must have a speed control system that is easy to operate (1 Marks)
5.4.3. The controls can be held comfortably, and the Deadman switch and speed control operated by the single hand holding the control. (1 mark)

Evaluation process:
The judge will look at the controls and examine for the speed control and Deadman switch.
The personal transport system will be held off the ground by the team and the power shall be turned on. While the power is on the Deadman switch shall be released and the system must come to a sharp or gradual stop. If the system stops naturally or quickly the marks are awarded.
The personal transport system will be held off the ground by the team and the judge will operate the speed control, observing a change in speed of the system. If a change in speed is observed, then the marks are awarded.
The judge will operate the controls with one hand only. If the previous tests can be completed with only one hand, the marks will be awarded.
Note: It is enough to judge that the first 2 criteria can be met in any method, but the third criterion requires they can be done with only one hand.

5.5. SAFETY (4 MARKS)

All movable components shall be guarded from access with an item larger than a bar of 12 mm in diameter and 75 mm in length.
The only movable part that can be allowed to be seen is the wheels if the system has wheels. This does not apply during setup and packing.
All conductive components electric circuits shall be guarded from access.
All sharp edges shall be removed.
The personal transport system shall have appropriate caution labels to warn the operator of danger. The label positions shall be checked in accordance with the operation guide.

Marks per Aspect:

Maximum Marks: 4

5.5.1. All movable components shall be guarded from access with a 75mm or longer rod of 12mm in diameter. If this rule is not observed, 0.2 Mark will be subtracted from the score per region not complying with it. (1 Mark)

5.5.2. All conductive components of electric circuits shall be guarded from access. If this rule is not observed, 0.2 Mark will be subtracted from the score per region not complying with it. (1 Mark)

5.5.3. All sharp edges shall be removed. If this rule is not observed, 0.2 Mark will be subtracted from the score per region not complying with it. (1 Mark)

5.5.4. Caution labels shall be affixed as specified in the operation guide and must include warnings for each moving part. If the specified labels do not match, 0.2 Mark will be subtracted from the score per missing or wrong label. (1 Mark)

Evaluation process:

All exposed parts shall be checked, including edges that the driver can check in an ordinary operation status.
All movable components and clearances shall be checked with a bar of 12mm in diameter and 75 mm in length, simulating a finger. If the bar contacts any movable component, a pinch Mark will be assumed there.
During the test, guards shall not be bent physically or moved manually.

5.6. STOPPING IN A SAFE DISTANCE (2 MARKS)

The personal transport system will be able to be stopped within a distance of 500mm.

Marks per Aspect:

Maximum Marks: 2

5.6.1. Able to stop within 500mm

Evaluation process:

The nominated team member will be ready at the start line.
A judge will give a 3,2,1 call followed by “go”
The nominated team member will move towards the breaking line 2M away. The personal transport system must cover the 2M in under 5 seconds from “go” or the score will be 0 for this test.
Once the stop line is reached the personal transport vehicle must come to a complete stop within 500mm, before the second line.
During the entire operation the nominated team member can not touch the ground until the personal transport system has come to a complete stop.

5.7. SPEED TEST (2 MARKS)

The personal transport system must be able to reach a minimum speed of 6KPH in a straight line

Marks per Aspect:
Maximum Marks: 2

5.7.1. The personal transport system must reach a minimum of 6KPH

Evaluation process:
The Team must cover a distance of 10 meters in 6 seconds or less.
The team will be allowed a run up to accelerate to the required speed.
Once the team crosses the start line, 3 judges will start their stopwatch.
When the second line is crossed the stopwatch will be stopped.
If all judges record a time under 3 seconds the marks are awarded.
If all are not under 3 seconds the average time is used and must be under 3 seconds to be awarded.

Note, if one judges time is disproportionate to the other two, that time will be discounted and the average of the remaining 2 used.

5.8. SYSTEM INTERFACE (6 MARKS)

The personal transport system shall have an interface that relays battery charge status and speed to the user.

Marks per Aspect:
Maximum Marks: 6

5.8.1. The battery charge status is displayed (3 Marks)
5.8.2. The current speed is displayed (3 Marks)

Evaluation process :
The team will demonstrate the system of their choosing to the judge when asked.

Note: It is enough for these systems to display reasonable figures. For speed this should be demonstrated as varying with varying wheel speeds.

5.9. STRAIGHT LINE RACE (4 MARKS)

The teams shall compete in a straight-line race. Teams will race for 20 metres in pairs. Each team shall race each other team and their first and second positions noted.

Marks per Aspect :
Maximum Marks: 4

5.9.1. Team with the lowest number of wins (0 Marks)
The team with the highest number of wins (2 Marks)
All other teams will receive a score proportional to their number of wins between.

Evaluation process :
The teams will race against every other team in the group. The number of wins and losses will be recorded.
Each pair will race over 20 meters. The Judge will give a 3,2,1 “go” to start the race.

The team with the highest number of wins will score maximum points. The team with the lowest number of wins will score 0 All other teams will be graded proportionally in between.

5.10. FLASHING LIGHTS (2 MARKS)

Each personal transport system shall have flashing lights front and back when turned on to warn of its use and proximity to other path or road users.

Marks by aspect:
Maximum marks: 2

5.10.1. Flashing lights at the front of the personal transport system (1 Marks)
5.10.2. Flashing lights at the back of the personal transport system (1 Marks)

Evaluation process:
The team will demonstrate the flashing lights to the judge when asked. The lights must only work when the Deadman switch is pressed and at no other time.

5.11 BATTERY SYSTEM (2 MARKS)

The personal transport system must be powered by a battery or batteries. The battery may be housed anywhere on the vehicle or user, including the Backpack.

Marks per Aspect:
Maximum Marks: 1

5.15.1 The system has a battery power supply (2 Mark)

Evaluation process:

The team will demonstrate to the judge that their product has a battery or batteries.

5.12 COURSE TIME TRIAL (10 MARKS)

The team shall nominate one user to take part in the time trial. The personal transport system will be required to complete four stages of the course as shown in appendix 1.

Note: the stages may be attempted in any order or direction the team deems best for them, but all four sections must be attempted.

Marks per Aspect:
Maximum Marks: 10

15,16.5 completing the time trial in the fastest time. (10 Marks)

Evaluation process:

Teams will attempt the course one at a time. The judge will give a 3,2,1 “go” and the timer will be started.
The nominated team user will undertake the course.
If the user touches the ground during any section or the personal transport system loses power, 0 marks are awarded for that section only.
If the ground is touched during the trial 10 seconds is added.
If the personal transport system runs over the edges of the course or touches an obstacle 5 seconds are added for each time to the final time.
The highest rank scoring 2 marks and the lowest 0. All others ranked in order proportionally between.

5.13 DISTANCE COVERED (4 MARKS)

The team will nominate a person to cover a 4Km distance trial.
Teams may put fresh batteries into/or charge the personal transport system before this test commences.
The team will be required to cover 4KM and will be timed doing so.

Marks per Aspect:
Maximum Marks: 4

5.17.1 Completes 4KM on one charge (1 Marks)

5.17.2 Completes 4KM as quickly as possible. (3 Marks)

Evaluation process:

The nominated person will be required to pilot the personal transport system for a total of 4km. Each teams time for this will be recorded as well as the distance covered, by completing laps of a track.
A judge will be responsible for timing each team.
The personal transport system will be piloted to lap the track for as long as it takes to complete 4KM
All teams completing sufficient laps will score 1 marks
The fastest team to complete the 4M will receive 3 marks. The slowest team will score 0 marks as will all teams not completing the distance.
All other finishing teams will be marked proportionally according to their time using the CIS system.
O marks are awarded if the course is not completed.

5.14 CONFORMITY TO DRAWINGS (4 MARKS)

A sample of 4 parts will be checked on the personal transport system. Each part will be examined to ensure it conforms to the drawing submitted by the teams.

Marks per Aspect: 4
Maximum Marks:

5.14.1 Part 1 conforms to the drawing submitted by the team (0.8 Marks)
5.14.2 Part 2 conforms to the drawing submitted by the team (0.8 Marks)
5.14.3 Part 3 conforms to the drawing submitted by the team (0.8 Marks)
5.14.4 Part 4 conforms to the drawing submitted by the team (0.8 Marks)
5.14.5 If all checked parts conform, then a bonus is awarded. (0.8 Marks)

Evaluation Process:

Experts will agree 4 common parts in all designs that will be inspected. These 4 parts and only these 4 parts, will be checked against the drawings submitted by teams.

Each part will have its sizes measured, its positions of holes or cuts and any angles measured. These will be checked against the drawing and tolerances stated. For each part that conforms 0.4 marks are awarded.

If all four checked parts conform to the drawings, then an extra 0.4 marks will be awarded.

5.15 PACKED VOLUME OF THE PERSONAL TRANSPORT SYSTEM (2 Mark)

The volume of the personal transport system while packed in its entirety into the Backpack will be measured and calculated

Marks per Aspect: 2

Maximum Marks:

5.15.1 The Rucksack containing all parts will be measured and the volume calculated (2 Mark)

Evaluation Process:

The team shall place the Backpack containing all parts on the bench. They may arrange however they wish, but all parts must be placed into the backpack while the judge observes.

The judge will then measure the length, width and height of the Backpack and use this to calculate the volume. The measurements shall be the widest, longest and highest points observed by the judge.

The smallest volume shall receive 2 mark, the largest shall receive 0 marks. All others shall be awarded proportional marks between using the CIS system.

6.1 GENERAL RULES

- ✓ During all times that the personal transport system is being used, the pilot must wear a helmet.
- ✓ Each team must nominate a pilot for each criterion, but every team member must pilot the personal transport system for at least one of the tests.
- ✓ The backpack can be purchased or manufactured prior to the competition to suit the design for each team but must be costed as a purchased item £25, a manufactured item £50.

6.2 WORKING HOURS

When one member of a team is working, all the team members will be counted, therefore team cost would be 90€/hour. Labour and equipment costs when working on the Surprise Project are to be included with the Main Project labour and equipment costs.

6.3 ADDITIONAL COST FOR USING EQUIPMENT

For using workshop equipment, e.g. welding, grinding, sheet metalwork, pillar drill and saw: 15 €/hour
For using a conventional mill and lathe: 25 €/hour
For using a CNC mill: 35 €/hour
Consultant or training services: 60 €/hour

Evaluation process:

The minimum time for booking each machine is fifteen (15) minutes, and 15-minute intervals thereafter.

Note: After using a machine, the machine must be cleaned, i.e. swarf removed from working area of the machine. Each machine will be inspected by an Expert after each team's use of that machine and a penalty of 22.50€ (representing 15 minutes of cleaning time) will be applied if the machine is not cleaned. If a machine is considered not cleaned, Experts will be called to inspect that machine – three Experts must agree. Their decision is final. Equipment use costs only to be applied to equipment supplied by the organizers. No cost for using portable equipment provided by teams.

6.3.1 It will be inspected by an Evaluator to clean and organize the work area of each team. This inspection will be held twice a day during the competition and a penalty of 22.50 € (representing 15 minutes cleaning time) will be applied to the team. If the workspace is considered unclean and unorganised, evaluators will be called to inspect the desktop - three evaluators must agree.

6.4 RAW MATERIALS

Each team will provide weight of raw materials used and also cost of raw material using cost per kilogram listed below. The list of raw material details including weight and cost is to be presented in spreadsheet format and to be included in section A of portfolio. Extrusions and profile will be priced by length. Cost must be verified by Experts to reflect commercial cost. Cost for raw materials to be applied:

- ✓ Mild sheet – 7 €/kg
- ✓ Aluminium – 10 €/kg
- ✓ Brass – 37 €/kg
- ✓ Stainless steel – 28 €/kg
- ✓ Plastic – 20 €/kg
- ✓ PCB – 0.50 €/cm²
- ✓ Batteries Pb, NiCd, NiMh etc - 0,5 €/Wh
- ✓ Batteries Lithium – 1.5 €/Wh

6.4.1 Components (Mechanical & Electronic)

Each team must provide a printed copy of electronic catalogues and web pages informing the costs of the components, starting from the informed date of reference of quotation ("Currency conversion rates").
In the proof sheets, they must be marked / identified:

- ✓ Search date (automatic information when printing information from a site);
- ✓ Website search address;
- ✓ The name of the component;
- ✓ The price used;
- ✓ Pages to be numbered according to the order of presentation in the List of all Materials and Components.
- ✓ A reference number on the price list that matches the reference number with the evidence of catalogue price.
- ✓ The spreadsheet must be filled in the same twatermark
- ✓ emplate sent to the forum. Different worksheets or different settings will not be accepted. Undoing the item cost score.

Note: Currency conversion rates will be fixed at Wednesday, April 01st, 2019, and will be taken from http://www.xe.com/. These exchange rates will be posted on the MTC discussion forum on this date.

6.5 COST CALCULATIONS (10 MARKS)

Costing will be broken down into the following groups

6.5.1 **Working hours** – 5 marks. The time will be transformed into cost, the final cost will be proportional to the compliance to specification of the Project, after applying compliance to specification, the team will receive 0 point for the most expensive cost and 5 points for the cheaper cost, and the other teams will receive proportional score between both. The marks will be distributed in three days.

6.5.2 **Additional cost for using equipment** – 3 marks. The time will be transformed into cost, the final cost will be proportional to the compliance to specification of the Project, after applying compliance to specification, the team will receive 0 point for the most expensive cost and 3 points for the cheaper cost, and the other teams will receive proportional score between both. The marks will be distributed in three days.

6.5.3 **Raw materials** – 2 marks - It will be considered the total cost of materials and components used in the project, which will be proportional to the compliance to specification of the Project, after applying compliance to specification, the team will receive 0 point for the most expensive cost and 2 points for the cheapest cost, and the other teams will receive proportional punctuation between the two.

Note: Only the teams that attain a minimum mark of 50% on the Main Project will be awarded marks in this section

Step 1

The total cost of equipment, materials and labour will be modified by project compliance to specification.

Final Cost = $\frac{\text{Total Cost x 100}}{\text{\% compliance to specification}}$.

Example:

- ✓ If total cost is € 2.500,00 and compliance is 100% then build cost would be € 2.500,00
- ✓ If total cost is € 2.500,00 and compliance is 80% then build cost would be € 3.125,00
- ✓ If total cost is € 2.500,00 and compliance is 60% then build cost would be € 4.167,00
- ✓ If total cost is € 2.500,00 and compliance is 50% then build cost would be € 5.000,00
- ✓ If total cost is € 2.500,00 and compliance is 49,99% or less no marks awarded for cost section.

Note: Marks will be calculated using calculations in the CIS scoring system

7 PORTFOLIO ASSESSMENT SECTION A

The portfolio will consist of two sections, section A and section B:

- ✓ The section A will be presented prior to the Competition and will be assessed during the Competition. All portfolios are to be in the English language.
- ✓ Only sheets that are attached inside in the folder will be accepted for evaluation (untied sheets will not be evaluated).
- ✓ The section A is to be presented in hard copy form, and should include:
- ✓ Video;
- ✓ List of all materials and components and their costs (with evidence) provided by the team. (provide a digital copy on USB memory stick for ease of evaluation);
- ✓ Operation and maintenance manual.

Note: When assessing the portfolio using the above criteria, it is enough to award marks for inclusion of the information when it comes up to the minimum requirements, rather than consider the actual detail contained within it. Marks are awarded for each item as if acceptable – full marks, or if not acceptable – zero marks. (There will be no graduated marks)

7.1 POSTER (4 MARKS)

A Poster is also to be displayed explaining to the public how the personal transport system operates.

Marks per Aspect:

Maximum Marks: 4 marks

To include:

- 7.1.1 Team name (0.4 marks)
- 7.1.2 3D picture of the personal transport system. (0.8 Marks)
- 7.1.3 Description of the personal transport system. (0.8 Marks)
- 7.1.4 Team names, courses studied and or Work position. (0.4 Marks)
- 7.1.5 Poster in colour. (0.4 Marks)
- 7.1.6 Poster is at least 600mm x 1000mm (0.8 Marks)
- 7.1.7 Poster is displayed during the competition. (0.4 Marks)

Evaluation process

Experts will check if the video is complete and meets minimum requirements. The title and artist will be checked for copyright free verification. 7.1.7 will be scored as 0 for all sections if the music is subject to copyright.

The team should provide the video on the pen drive USB on the day of familiarization, if not deliver will not participate in the score.

7.2 LIST OF ALL MATERIALS AND COMPONENTS PROVIDED BY THE TEAM (4 MARKS)

Each team will provide the weight of raw materials used together with the cost of raw material using cost per kilogram listed below. The list of raw material details including weight and cost is to be presented in spreadsheet format and to be included in section A of the portfolio. Refer to the raw material cost section to know the prices applied. Extrusions and profile sections will be priced by length. Cost must be verified by Experts to reflect commercial cost. Cost for raw materials to be applied:

For each used purchased item a receipt or a current catalogue price (without discounts or goods and services taxes applied) must be provided. A printout of a website is acceptable if website address and date are included on printout. Each piece of evidence must be cross referenced to the costs spreadsheet.

A list of purchased items, raw materials and their costs is to be presented in Spreadsheet format.

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Marks per Aspect:

Maximum Marks: 4 marks

7.2.1 2 mark if the spreadsheet contains all raw materials, purchased items, and is complete and in spreadsheet format meeting the minimum requirements – drawings will be checked for materials and components.

7.2.2 Evidence is provided of the raw materials and components provided by teams and is fully cross referenced to the cost's spreadsheet- 1 marks

7.2.3 List in English language – 1 marks

Evaluation process

Experts will check if the spreadsheet is >95% complete and meets minimum requirements.

Experts will check if the evidence of cost is present for all listed items and that items are correctly cross referenced.

Evaluators will check if the sheets are attached in the folder, if not, zero marks.

Experts will check the list of devices with the fixed devices, if they are informed and in red colour, in case some information is missing to eliminate the device of the competition.

Check if the spreadsheet was used according to the model sent in the forum, if not, zero marks.

Check the prices and quantities if they are in accordance with the Assembly Drawing Draft and the Electronic Catalogue, if you do not present the Assembly Drawing with the complete parts list or the Electronic Catalogue, cancel the score.

7.3 OPERATION AND MAINTENANCE MANUAL (4 MARKS)

An operation and maintenance manual for the personal transport system is to be provided
(The other controls for operation of the personal transport system should be clearly described in the Operation and Maintenance Manual)
Assessment by judgement process.

Marks per Aspect:

Maximum Marks: 4 marks

To include:

- ✓ Set up of the personal transport system
- ✓ Operation of the personal transport system
- ✓ Replacement of batteries, wheels and/or tracks
- ✓ Safe operating procedures
- ✓ Presented in a folder
- ✓ List and place of caution labels on the personal transport system
- ✓ Manual in English language

Evaluation process

The assessment process will be applied by judgement, details see Technical Description.
A team of 3 Expert´s will observe the Project.
The team should observe if there are failures and how many failures there are.
Classify the type of failure, whether it is high impact or low impact and it will apply the vote using the scale of 0 - 3.

- ✓ Scale 0: You do not meet the market standard.
- ✓ Scale 1: Satisfy the industry standard.
- ✓ Scale 2: Satisfy the market standard.
- ✓ Scale 3: It exceeds the Market standard.

7.4 SALES BROCHURE (4 MARKS)

Each team will provide 5 copies of a sales brochure for their product in English. A further 5 copies should be provided in Welsh.
The brochure should be designed to market the product to the general public.
The brochure should include the at least 10 photographs of the project.
The brochure should include at least 4 reasons to purchase the item.
The brochure should include and explanation of all functions of the project.
The brochure should include the battery longevity.
The brochure should be produced in full colour.
The brochure should be A5 in size when closed and must be stapled centrally from A4 printed sheets.
The brochure should be of sufficient quality to be given to prospective customers.

Marks per Aspect:

Maximum Marks: 4 marks

7.4.1 5 Brochures are provided in English Language. (0.4 Marks)
7.4.2 5 Brochures are provided in a language other than English. (0.4 Marks)
7.4.3 The brochures include 10 Photographs. (0.4 Marks)
7.4.4 The brochure contains at least 4 reasons to purchase the product. (0.4 Marks)
7.4.5 The brochure explains the use of all control systems (0.6 Marks)
7.4.6 The brochure includes the time the battery will last in the project under use and standby. (0.4 Marks)
7.4.7 The brochure is printed in full colour. (0.4 Marks)

7.4.8 The brochure is made from A4 prints, stapled centrally and neatly folded into an A5 brochure. (0.4 Marks)

7.4.9 The brochure is of a sufficient quality to attract potential customers. (0.6 Marks)

Evaluation process

The Brochures will be presented to Experts at the start of C1.

Experts will count the Number of brochures in English and if 5 or more are provided 0.4 marks will be awarded.

Experts will count the number of brochures not in English and if 5 or more are provided 0.4 marks will be awarded

Experts will examine 1 copy of the English and 1 copy of the Non-English brochure. The number of Photographs will be counted. If 10 or more are included in each 0.4 marks will be awarded.

Experts will examine the brochure for sales reasons the project should be purchased. If four or more reasons are given 0.1 marks are awarded.

Experts will examine the brochure for an explanation of all controls asked for in the brief as well as an explanation of the LCD display and meanings asked for in the brief. If all are present 0.4 Marks will be awarded.

Experts will examine the brochure for the standby time of the project and the time the project can be used under a single battery charge. If both are present 0.4 marks are awarded.

Experts will examine every page of the brochure to ensure it is printed in full colour. If all pages are colour then 0.4 marks are awarded.

Experts will examine all 10 presented brochures. Each brochure should be folded from A4 paper, centrally stapled and be of the size 148mm x 210mm +/- 2mm and be neatly folded with no overlapping edges. If this all conforms, then 0.4 marks are given.

Experts will during C1 and C2 approach on lookers with a copy of each team's brochure. The public will be asked to rank the appearance and appeal of the brochure from best to worst. 1 being for the best, number of teams for the worst.

Each team's ranking numbers will then be totalled up. For the lowest total score the team receives 0,4 marks, for the highest total score the team receives 0 marks, all other teams graded proportionally between.

8 PORTFOLIO ASSESSMENT SECTION B

The section B of portfolio includes documentation prepared during the Competition. The time taken to complete this section will be costed as part of the Main Project. Assessment of section B is included in the Main Project assessment.

8.1 VISUAL QUALITY OF DRAWINGS (2 MARKS)

Drawing will be observed to evaluate if their quality, attention to the needs of manufacture and presentation are representative of what is expected in the engineering industry.

Marks per Aspect:

Maximum Marks: 1 mark

From 0 marks for drawings which are poorly presented and not fit for purpose up to 1 mark for the drawings that totally meet industrial standards and are easily interpreted.

Evaluation process

The judgment assessment process will be applied to award marks.

A team of 3 Expert´s will observe the Drawings.

The team should observe if there are failures and how many failures there are.

Rate the type of failure, whether it is high impact or low impact and will apply the vote using the 0-3 scale.

- ✓ Scale 0: You do not meet the market standard.
- ✓ Scale 1: Satisfy the industry standard.
- ✓ Scale 2: Satisfy the market standard.
- ✓ Scale 3: It exceeds the Market standard.

8.2 2D DETAIL DRAWINGS (8 MARKS)

CAD generated manufacturing drawings (2D detail drawings) of a minimum of 90,00% of all manufactured components of the personal transport system are to be created during the Competition and be presented for assessment in a folder.

Marks per Aspect:

Maximum Marks: 8 marks

2 mark if more than 90,00% of drawings for manufactured and modified parts are presented.

6 marks if drawings are acceptable. Mark Allocation for each drawing:

- 8.2.1 0.5 marks if drawing has title block drawing title, drawing number (must refer to assembly drawing), sheet number, paper size, scale and drawing border
- 8.2.2 0.5 marks if drawing contains correct views and projection
- 8.2.3 0.5 marks if drawing is accurate to the personal transport system. Components will be measured by Experts to confirm that they are manufactured to the drawing
- 8.2.4 0.5 marks if drawing has appropriate (i.e. Can the component be manufactured from the details shown on the drawing) dimensions with tolerances or/and general tolerance, and machine finishes (where required)

Evaluation process

Note: only manufactured items and modified by the team during the Competition must be drawn in 2D.

✓ STEP 1

The Expert´s will count the number of drawings required for all manufactured and modified components – Must check personal transport system for all manufactured/modified components and/or copy the drawings delivered on the day of familiarization.

Count the number of drawings presented in the portfolio and calculate the % submitted.

✓ STEP 2

Select three (3) drawings randomly (independent Expert to select) - assess these drawings only – each drawing can get 2 marks maximum. Marking is to be recorded on a chart which is to be verified by all members of the marking team.

Note: If drawing is not CAD/electronically created no marks will be awarded.

The Experts will not draw the drawings from the pockets to evaluate, except drawings printed in A3.

8.3 ELECTRICAL/ELECTRONIC CIRCUIT DRAWING (4 MARKS)

Marks per Aspect:

Maximum Marks: 4 marks

8.3.1 1,0 marks if drawing has drawing title, drawing number and drawing border;

8.3.2 1,0 marks if the electronic diagram design is in accordance with the standard.

8.3.3 1,0 marks if drawing to contains battery, motor, and switches, display.

8.3.4 1.0 marks if 90% of components listed in the costing spreadsheet are included.

Evaluation process

Experts will check if the drawing(s) are complete and meet minimum requirements.

If drawing is not CAD/electronically presented, then no marks will be awarded.

The Electrical drawings must conform to:

1) Wires connecting must be indicated by a heavy black dot, wires crossing but not connecting have no dot.

2) Four wires must not connect at a single node.

3) Always use the same symbol for the same device.

4)Wires and components are aligned horizontally or vertically, unless there is a good reason to do otherwise.

5) Label pin numbers on the outside of a symbol, signal names on the inside.

6) All parts should have values or types indicated and a circuit designation, as used to identify them within the costing's spreadsheet.

Experts will check the costing Spreadsheet for electronic components and compare the components in all drawings. 90% of all components must be included in the drawings.

Note: *The Experts will not draw the drawings from the pockets to evaluate, except drawings printed in A3.*

8.4 3D ASSEMBLY DRAWING (1 MARK)

A CAD generated 3D assembly drawing (3D model) of the complete unit(s) is to be created during the Competition and a printout to be presented for assessment in a folder.

Marks per Aspect:

Maximum Marks: 2 mark

8.4.1 1,0 marks if drawing contains a minimum of 90% of manufactured/modified/purchased components and if drawing has a parts/material list which also shows reference to the detail drawings

8.4.2 0,5 marks if drawing has drawing title, drawing number, sheet number, and drawing border

8.4.3 0,5 marks if drawing has the complete manufactured chassis is included in the drawing.

Evaluation process

Experts will check if drawing is complete and meets minimum requirements.

The Experts will check se all components (manufactured/modified/purchased) have reference in the 3D drawings and must contain in the parts/material list of drawing (3D). Minimum requirements are 90%.

If the drawing is not CAD/electronically generated no marks will be awarded

Note:

- *Purchased items may be drawn as a block and not drawn in detail.*
- *Assembly drawings may be presented on more than one page, for ease of interpretation and evaluation.*
- *The Experts will not draw the drawings from the pockets to evaluate, except drawings printed in A3.*

8.5 PRESENTATION OF DRAWINGS (2 MARK)

Drawings must be presented in a folder with team identification label.

Marks per Aspect:

Maximum Marks: 2 mark

8.5.1 2 marks if drawings are presented in folder with teams' identification. (1 Marks)

Evaluation process

Experts will check if the drawings are presented as required.

The folder must be of the office folder type.

The sheets of drawings must be distributed in various A4 clear plastic punched pockets.

Drawings printed in A4 size, can be placed in the pocket in a maximum of two drawings, but always positioned against each other.

Printed drawings in A3 size must be properly folded and put in the A4 clear plastic punched pockets. A sheet per pocket.

The Experts will not draw the drawings from the pockets to evaluate, except drawings printed in A3.

Note: The drawing sheets should be fixed inside the folder. Loose drawing sheets inside the folder will not be accepted or evaluated.

9 PENALTIES

Here is the list of penalties set in the lasts WorldSkills Competitions.

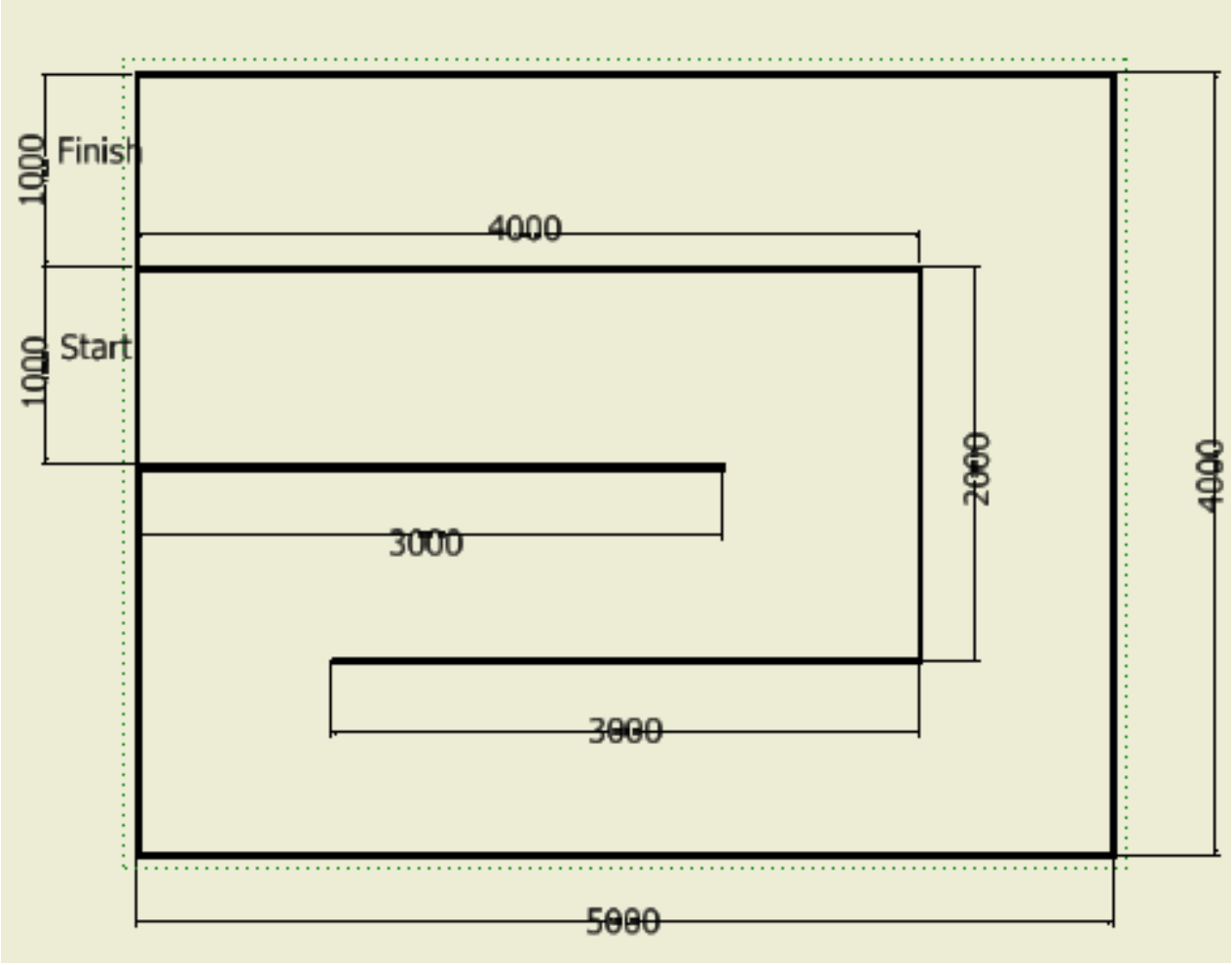
If the team commits some of the penalties below, they will be penalized according to the table below.

Cases not foreseen here, will be penalized according to the approval of the majority (50% + 1) of the Experts.

N°	DESCRIPTION	PENALTIES
1	Components modified prior to the competition (Low complexity).	The Experts will study the compenent and determine its complexity. The time for construction/modifcation will be determined and multipied by 3 and added to the team time.
2	Components modified prior to the competition. (High complexity).	The team must arrange a new item, or if it is not possible, the team will be disqualified. The team will be invited to participate in the competition, but you will not allowed to compete for any medals.
3	Components with many functions.	The team must arrange a change of design to the component for another design uning separe components, if it is not possible, the team will be disqualified. The team will be invited to participate in the competition, but you will not be allowed to compete for any medals. For example: Wheel with integrated engine (2005, Finland).
4	Pre-assembled components	The team is invited to disassemble the component before starting the competition. If it is not possible, the advantage time is calculated, This time is multiplied by threee and added to the Working Hours Criterion.
5	Pre-machined parts	The team is invited to change the piece(s), if it is not possible, the manufacturing time is calculated and the time is multiplied by 3. This penalty time is added to the Working Hours criterion.
6	Failure of a team to give notice, (Booking) of machinery begore start and/or at the end of machinery usage time.	On day C1 (first day of competition teams will be notified verbally), on days C2 and C3, teams will receive 1 hour penalties for the corresponding equipment. This will be added to the Equipment usage criterion.
7	Unsafe activities such as running in the area or non-use of PPE	First the Expert stop competitor activity, and ask to them to correct it. Penalty of 1 hour in the hours worked for each warning, starting from C2 and C3. This will be added to the Working Hours Criterion.
8	Missing items or information in the Materials Spreadsheet	Penalty of 3x the value of the item will be added to the Raw Materials criterion.
9	Evidence with evidence of fraud	Apply a fine of 10x the value of the item in relation to the Market, and sum in all cost criteria (Hours Worked, use of Equipment and Materials)
10	Deliberatley tampering with another teams project or leaving equipment in an unusable or tampered with state.	The team will be disqualified. The team will be invited to participate in the competition, but they will not allowed to compete for any medals.
11	Unsportsmen like conduct, including but not limited to: Breaking of competition rules, interfering with another team, conduct from a team or judge compatriot to a team that seeks to influence the outcome of the competition.	The team will be disqualified. The team will be invited to participate in the competition, but they will not allowed to compete for any medals.

10 APPENDIX

10.1 Test course [Appendix 1]



11 MARKING SCHEME

ASSESSMENT CRITERIA

SECTION	CRITERIA	MARKS
A	Main Project performances (including section B of portfolio)	56
B	Main Project costs (including time to complete section B of portfolio)	10
C	Portfolio (section A only)	34
	Total	100