

Electronics & Data Acquisition Team Proposal

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Abstract

A brief overview of how the Electrics & Data Acquisition team will operate over the 2015/2016 season and what their aims and high-level objectives are, while stating how these will be achieved and also what benefit that they pose for the team as a whole.

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# Introduction

## High level strategy

For HWRacing’s 2015/2016 season, it is the intention to run the Electrics & Data Acquisition team in a different fashion, whereby they operate with greater independence than in previous years. By proposing yearly or semesterly targets to the Project Manager and the Technical Director, once agreed they are then allowed to set their own sub-goals in order to meet these targets with regards to data acquisition development and systems work.

When considering the electrics work, strict deadlines shall be placed on the electrics team with regards to completing the manufacture of the wiring harness, completing the static reports and the costing report.

With this, the electrics team do not hold up the other sections and vice-versa, the other sections are not holding up the electrics team by potentially missing deadlines etc., which was noted in the previous season, (2014/2015), whereby during the test car build (HWR-04), through no direct fault from any other particular team, the Electrics team ended up waiting idle for other work to be carried out first. With this proposal, this would not occur.

At the end of the season (2015/2016), the Electrics Team Leader should conduct a review to evaluate the performance and effect of implementing this new strategy, presenting potential improvements to be taken forward into the next season.

## Year plan

Once a team level plan has been finalised and once the Electrics Team Leader receives the crucial deadlines from the Project Manager, then an Electrics team year plan can be constructed to work with the deadlines. And then proposed to both the Project Manager and Technical Director. With this complete, individual, lower-level tasks can be generated and then planned in accordance with the task’s priority.

# Electrics Team Responsibilities

By breaking down the Electrics Team’s responsibilities into; Electrics (Wire Harness, Test Looms, Design Report and Cost Report, for example), Electronics (Data, Circuits, Test Rigs, for example) and providing a level of IT support to the team, each one of these responsibilities can be broken down further into aims of what we want to achieve by FS UK 2016, how these will be met and how they benefit the greater team.

## Electrics

The Electrics responsibility is a continuation from what was done in the previous season.

### Aims

* Provide a fully operational wiring harness to the HWR-05 car by the agreed deadline.
* Ensure the reliability of the provided wiring harness by conducting testing on the system
  + Physical wear
  + Ingress protection (dirt and water)
  + Vibration
  + Pull-out
* Provide a fully operational wiring harness to the HWR-04 testing car by the agreed deadline (if required).
* Be available for on/off site testing to provide Electrics support
* Fully develop the Electrics system in the HWR-05 CAD model by the agreed deadline.
  + Wiring harness including routings and accurate estimate of weight
  + Component Mounting
  + Panels and brackets
  + Connectors included in CAD
  + From CAD, get an accurate BOM for wire lengths, components and consumables
* Provide a finished, accurate Cost Report document of the HWR-05 Electrics Systems by the agreed deadline.
* Provide a detailed Design Report on the Electrics section for HWR-05 by the agreed deadline.
* Provide a synopsis on the Electrics Team progress for the Design Report submission for HWR-05 by the agreed deadline.
* Provide the information required by the Essential Information form by the agreed deadline.

### How will we meet these Aims?

As the Electrics is the main focus and the area which is critical to HWR-05’s success, the team will prioritise the above mentioned aims (Section 2.1.1) above other responsibilities to ensure the success of the project.

### What is the benefit of these being our aims?

With a well-constructed and agreed Electrics plan in place unreliability can be minimised through not rushing to finish the work and it will allow the team to test the wiring harness, further improving the reliability of the system.

With reliability comes a considerably better chance for the team to complete all dynamic events at FS UK 2016, with the main focus being completing the Endurance event.

Furthermore, with the static events, we aim to gain points for the team in our design and cost events by preparing a detailed costing report, which has been lacking in previous entries and a well finished design report with adequate justifications and design work.

The presentation of a thought out and tested electrical system should mean that we have less issues with regards to scrutineering.

All combined, a substantial and notable improvement can be made from our previous class 1 entries by meeting the above aims, leaving the team in a better position moving into future years and satisfying the judges during static events.

## Electronics + Data Acquisition

The Electronics and Data Acquisition aspect of the team’s responsibilities is new, unchartered territory for HWRacing but is achievable within the timeframe to develop considerably which will benefit the team massively in the years to come.

### Aims

* Select several areas to focus on and get a basic system working and operational within the first year of development
  + Sensors (Physical and Virtual)
    - Wheel speed
    - ECU data (Virtual Sensor)
    - Pedal Force
    - Strain
    - Damper travel
    - Positional Data
      * IMU + Dead Reckoning
      * GPS
  + Calibration of sensors
    - Test rigs where necessary
    - Software calibration
  + Method of collection
    - Development of MBED system
    - Look into breaking system further down (layers of abstraction)
    - Develop library file of standard code to be implemented in the event of specific testing sessions
  + Communications
    - Car –> trackside
      * Protocol to assign priority
    - Trackside -> car (calibration)
    - Inter car communications (CAN network)
  + Data handling
    - Car side (on mbed)
      * Primary data (real time telemetry)
      * Secondary data (logging)
    - Trackside (Computer)
      * Parsing the incoming data
      * Displaying it in a meaningful way which is adaptable
      * Storing the data in a meaningful way
      * Post processing and review functionality
      * Combine with test logs to provide qualitative and quantitative data for best post-test analysis
      * Bespoke software to provide this functionality

### How will we meet these aims?

We will meet these aims by dividing up the work amongst the three members of the Electrics & Data Acquisition team, to cover more of the aims concurrently. Work must be conducted closely to involve each team member, to give everyone a good overview of the system and its development, which helps in the event of questions during competition, problems during testing sessions and also it will help develop the individual’s knowledge across a broader range of topics.

Tasks will be delegated to a person, assigning accountability as well as highlighting the responsibility that the team member in question has to finish the tasks in order to successfully finish the project.

Weekly team meetings and work sessions will be arranged where the Electrics & Data Acquisition team will work as a whole unit, to allow for direct communication and proper integration between the sections.

Before work begins, the system proposed will be properly broken down within a formal document, highlighting the product’s specifications, the individual inputs and outputs to the system and the person(s) responsible to deliver that section. This document will be used to drive the development of the system and limit integration/compatibility issues.

An online storage area for code (GitHub or similar) will be used to ensure that code document control is maintained, mbed code shall be kept within the team’s MBED online compiler account, and properly documented and revisions listed as well as the person listed who made the changes.

Online storage (Google Drive) shall be used to store the team’s paperwork, finished reports, finished diagrams and datasheets. OneDrive shall be used to allow collaborative writing of reports before they are finished and transferred over to Google Drive.

### What is the benefit of these being our aims?

By reviewing the feedback given by the FS UK 2015 judges, a large portion of the feedback related to a lack of validation techniques from FEA analysis. One way of overcoming this is to develop a reliable and accurate data acquisition system, as presented in Section 2.2.1, which will begin to collect real-life data of what any HWRacing vehicle is doing under a given situation; be it stresses, accelerations or wheel speeds. With this information, design teams can start to implement a “Data driven design” mentality which will improve the team’s overall mechanical understanding as well as being able to back up our design work with greater justifications and reasoning.

This exercise is within the team’s grasp given the abilities of the collective Electrics team, and given the success of the team in the previous season, there is now some slack time within our timescale to lay the foundations for this system. With that, such a system is sure to gain the team a considerable amount of points at competition as it shows an understanding for the need to develop this aspect of our team while not sacrificing the reliability or quality of the primary role of an electrics team; the construction of a loom for a competitive car.

Not only is this system limited to data acquisition, the ability to use the gathered data for driver training and selection is also valid. With having the driver’s timings, his stats and other information, informed decisions can be made with regards to his driving style in order to improve lap times and gain HWRacing more points at competition.

Lastly, with the USP (Unique selling point) for the Business team relating to the use of online diagnostics and telemetry, the Electrics team has an opportunity to actually develop this USP which is unusual and should lead to positive review from the judges. Further, with this, we can estimate a more accurate costing and testify to the plausibility of the system.