

Learning from other sectors: Williams F1



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Introduction

Williams Grand Prix Engineering Limited, trading in Formula One as Williams Martini Racing, is a British motor racing team and constructor. Formula One is well-known for being one of the most technologically advanced sports in the world, whose cars are essentially big data factories on wheels. They have hundreds of sensors across many components, collecting data on everything from fuel levels and engine performance, to oil temperature and tyre pressure, as well as aero development.

Turning that data into useful information to tweak a car's performance is nothing new in Formula One, but driving efficiency in the analysis process, so that data can shave race-deciding tenths of seconds from lap times, could be the difference between winning and losing.

There are essentially two races in Formula One: the one that most people are familiar with and the other race hidden from view - which is a lot larger - the development race. It happens in the factories of the Formula One teams around the country and across Europe, and it is an order of magnitude larger than the activity that is happening on race tracks at race weekends throughout the year. Three thousand people are involved, and over £1 billion is spent every year developing Formula One cars. If a team is not developing its car at a similar rate to its competitors, it is going to move backwards on the grid quite quickly.

Motivation

Big data collected from F1 cars is vital for maximising performance. It starts at the design stage of a new car, by using previous seasons' race data to identify where improvements can be made. Further

analytics can then be used to maximise the performance of components throughout the development process.

Data collected and analysed during wind tunnel testing is also used to develop the aerodynamics of the car, to extract the best performance within F1 regulations. F1 teams will also use the data gleaned from the process to configure the cars for track testing, and for each Grand Prix weekend.

Development

When the race starts, a team of engineers receives a deluge of data transmitted from the car, and use it to monitor the health and performance of the car, and inform tactics and strategies. The real-time data that teams rely on comes from multiple data sources, such as sensors, video-feed, on-car telemetry and simulations.

Efficiently preparing this data for analysis is key: engineers must not lose valuable time getting hold of the data they need to analyse, but instead must quickly gain the necessary performance information.

Stringent F1 regulations limit the time and resource teams are allowed to use to develop the car, both on track and in the factory. This puts a premium on extracting the maximum amount of useful information from the minimum amount of testing, requiring carefully designed experiments and efficient processes.

Results

One final area is the input from engineers and where they think they are going with the car. Do they want to change the set up of the car, target particular races or aim for a car that is particularly good in particular environmental conditions? These different

sources of information need to be gathered together and distilled into a consistent method for evaluating whether a new part or change increases performance according to the agreed development direction. This evaluation is made dozens of times each week in the wind tunnel testing, computational fluid dynamics development and elsewhere in the development process. This is a snapshot of some of the elements of the aerodynamics development process and how data is used in that process.

Next steps

Formula One technology is the constantly changing, either for compliance with the rules or the natural development that happens during a season. It never stands still and constantly innovates, working out at every Grand Prix throughout the season how to improve on what is being done.

To achieve in this environment, Formula One has to be able to unlock information and put it in the hands of people who can use it to make data-driven decisions, rather than relying on instinct.

There is a huge demand to transform processes and technology across the entire business, covering the whole lifecycle of the Formula One car, from aerodynamics and design to manufacturing and race engineering. Formula One needs to accelerate and improve how information passes between teams, in order to make that lifecycle much quicker.

This can happen in a number of ways. It could be improving the graphical user interfaces allowing easier interpretation of data by engineers. Or, it could be improving the workflow with an electronic system where they can push a button and receive the information they need, instead of relying on hundreds of pieces of paper.