

THE COCKPIT COACH

Data logging can play a key role in driver development. Graham Templeman finds out how from a team working hard to develop the stars of tomorrow



A TRADITIONAL comment made about motor racing is that it is one of the few sports where the competitor doesn't have the benefits of proper coaching.

Some of us will remember amazing photos of Jim Russell standing at the apex of a bend indicating the clipping point to students driving past at apparently racing speeds. But we also knew that, publicity shots apart, once the car was on-track, the driver was on his own.

Not any more. With data logging, the effects of every action taken by the driver can be examined in detail later on the screen of a laptop.

To find out how data logging contributes to driver development, we talked to Mike Rose, team principal of PR Motorsport. Mike has been running young drivers (14 to 17-year-olds) in T-Cars for the past six years and he's obviously very good at it. Both of his 2006 drivers, Adrian Quaife-Hobbs and Ollie Webb, have qualified for lucrative Formula BMW Scholarship awards for 2007.

In case it has passed you by, T-Cars have a space frame chassis with composite touring car bodywork and are

powered by sealed Mountune-prepared two-litre tuned Ford Duratec engines. They run on street-legal Avon ACB10 tyres and use their 145 bhp to propel them to a top speed of over 120 mph. Lucky 14-year-olds.

The data logging is controlled by the regulations, and a Stack system is required that logs revs at 20Hz, left front wheel speed and throttle position at 10Hz, and oil and water temperature and oil pressure at 1Hz. Oddly, lateral g is also required at 1Hz. Brake line pressure and fuel pressure are optionally measured at 10Hz. The use of an expansion module to go beyond the basic eight channels is permitted and the must-have here is steering wheel position.

There are two unexpected gems hidden in the T-car regulations. The first is that testing by the under 16s has to be carried out under supervision. These are powerful two-seaters driven by very young drivers and so the second seat is occupied by a driver coach. This is great for training and safety, but from the viewpoint of the race engineer there is up to 100 kg of ballast on one side of the car's centre line. This assault on the corner-weights makes detailed data

RIGHT This screenshot shows the sort of information that is made available to each competitor at the end of a session. The time line in the blue panel at the bottom of the screen shows the time differences between the two laps and provides food for thought for the team and the driver



LEFT Featuring 145 bhp and capable of 120 mph, T-Cars are playing an important role in developing young talent. The driver's every action can be examined in detail later

interpretation difficult because conditions are so different between testing and competition.

The other unexpected item is that the regulations require that all recorded data must be made available to the Championship Co-ordinator and Eligibility Scrutineer. After every official session, each competitor is provided with a printout that compares his or her time to the fastest in the session. The person putting up fastest time gets to see his own data compared with the data of the second fastest. This must be one of the few real cases of freedom of information.

As a training formula, enabling competitors to compare their data with the fastest is a great step along the way to

that the power levels are legal with acceleration figures that are consistent across all the cars and that the speed comes from the usual large number of small improvements that, individually, make little difference but all add together to make real gains.

The ethical issue comes with a corner such as Turn 8 at Knockhill (Taylor's Bend) where an incorrect approach speed can cost not tenths but whole seconds on the long straight back to Turn 1. The sharing of data immediately negates the advantages that come from talent intelligently applied.

Ethics apart, how does a top team bring on its young charges? Firstly, there are very few absolute beginners, with

most youngsters having had some karting experience. Apparently, karting does not breed a single style of driver. As in any form of motorsport, each driver is different and ex-karters might be aggressive or gentle with the machinery and brave or careful in their driving.

They have enough experience to

know what they want in the way of vehicle set-ups. The quality of the feedback also varies and the team has to be careful to check the feedback against the data. It has come across the schoolboy error confusing understeer with oversteer – well the car ran wide and the driver had to oversteer to get it back on line.

A lot of this sheer inexperience is revealed by the data. There is a tendency for some new drivers either to be 'over the top' or slightly overawed by their new surroundings. A screen that shows speeds, revs and time slip against a team-mate is a simple and unarguable way of demonstrating where mistakes are being made and where time can be found. ▶

“ Linking video footage to data develops the skill of being able to ‘see’ the data as representing a particular part of the track ”

seeing how things should be done. Whilst this is a real benefit for someone who is off the pace, it naturally rankles with the front runners like PR Motorsport when they are forced to disclose where they are making time.

Understandably, it can be a bone of contention.

PR Motorsport's tactical response to this, bearing in mind that all recorded data is to be made available, is to log only the minimum data required by the rules during official events. This means that the teams do not log things such as brake pressures and steering inputs during competitive running.

One positive side issue has been the ability to refute allegations of cheating. The data shows without argument

This is one reason why PR Motorsport tries to keep the set ups similar for the two cars that it runs. It helps in the very early stages of a driver's career although as they gain more experience, it is possible for different set ups to evolve to suit driver preference. This in itself can be a positive, because the benefits of two different approaches reveal themselves in the data. Mike has found that there his drivers have always been prepared to share data knowing that it will help both themselves and the team.

From the team's viewpoint, the first stage of data interpretation is to look at the car's vital signs – how are the

“ The approach of chasing the time slip is inevitably backward-looking ”

pressures and temperatures behaving? Gear ratios are fixed, so engine revs becomes a driving rather than a car preparation issue. Once satisfied that the car is okay, attention can turn to driver performance. As always, the basics of Speed, Revs and Time Slip reveal much of what is going on.

An important first step is to use the data to identify simple driving faults, if any. For most 14-year-olds simply making quick clean gear changes is an art that still needs to be

mastered. Showing time on the X axis allows the data engineer to measure the blip in the rpm trace and decide whether a young driver is managing to change in the requisite three or four tenths of a second. Difficulty in gear changing shows up as the engine revs going all over the place as the driver tries to find a cog.

Braking faults show up as well. The long g trace not only shows the maximum deceleration under braking but also how well the driver is using the pedal. It is human nature to want to get the braking done early and this will show up as a long g trace that oscillates up and down as the driver over-brakes for the corner, realises the mistake and gets off the pedal and then back on again. This is not the classically smooth two-sided valley from the perfect world.

The braking trace will also show whether braking is being done in a straight line. In this case, getting off the brakes will show as a relatively fast rise at the end of the trace. If the driver is trail braking into the corner the trace will show that he or she is coming off the pedal gradually as lateral g forces build up.

Once the basics have been covered, it's possible to move on to finding the more subtle increments of speed. This is where the time slip line comes into its own. Comparing two teammates and having the benefit of the organiser-provided fastest lap data shows up where time can be made up. Parts of the circuit where there is room for improvement can be identified





and it is possible to delve deeper into the data. Throttle position, brake pressure and steering wheel angle serve to show precisely what the driver is doing and the lateral g trace will show the impact that that has on the car's speed.

At this stage it is important not to concentrate too much on one limited part of the corner, but to realise that braking, corner entry, apex, exit and acceleration must be treated as a whole.

It is also important to have the right attitude to the data. The approach of chasing the time slip is inevitably backward-looking – trying to catch up with the best so far. Used slavishly, it can distract from the real objective, which is to improve on what has happened up to now. What must always be uppermost in everyone's mind is how things can be pushed forward.

Data interpretation is important, but it's not the only evaluation available to the team. The driver, although still learning the trade, is also closely involved and the only person capable of describing what the car felt like at a particular point.

In-car cameras are used and much use is made of Stack's ability to link the video footage to the data. This acts as an invaluable reminder to the driver about what was going on at a particular point and helps develop the skill of being able to 'see' the data as representing a particular part of the race track. Finally, this brings us back to the starting point: this is one of the few areas of motorsport where there really *can* be proper driver coaching. ■

LEFT Freedom of information: each competitor in T-Cars is able to compare their best efforts with those of the fastest driver. The rules require a Stack data logging system to be used

ABOVE Stack's ability to link video footage to data, seen here in a club test, helps develop the skill of being able to 'see' the data as representing a particular part of the track

RIGHT The driver may be alone in the race car, but the logging information enables the youngsters to be coached from the pit lane afterwards

