Topic	Studying tire warming strategies with the use of Thermal Imaging Technology
Company	A Formula 3 Racing Company
TeAx Solutions	ThermalCapture 2.0 640

Case Study for Formula 3 Racing Research – with ThermalCapture 640

Case #1: Studying tire warming strategies with the use of Thermal Imaging Technology

Image #1: heat generated by “weaving”

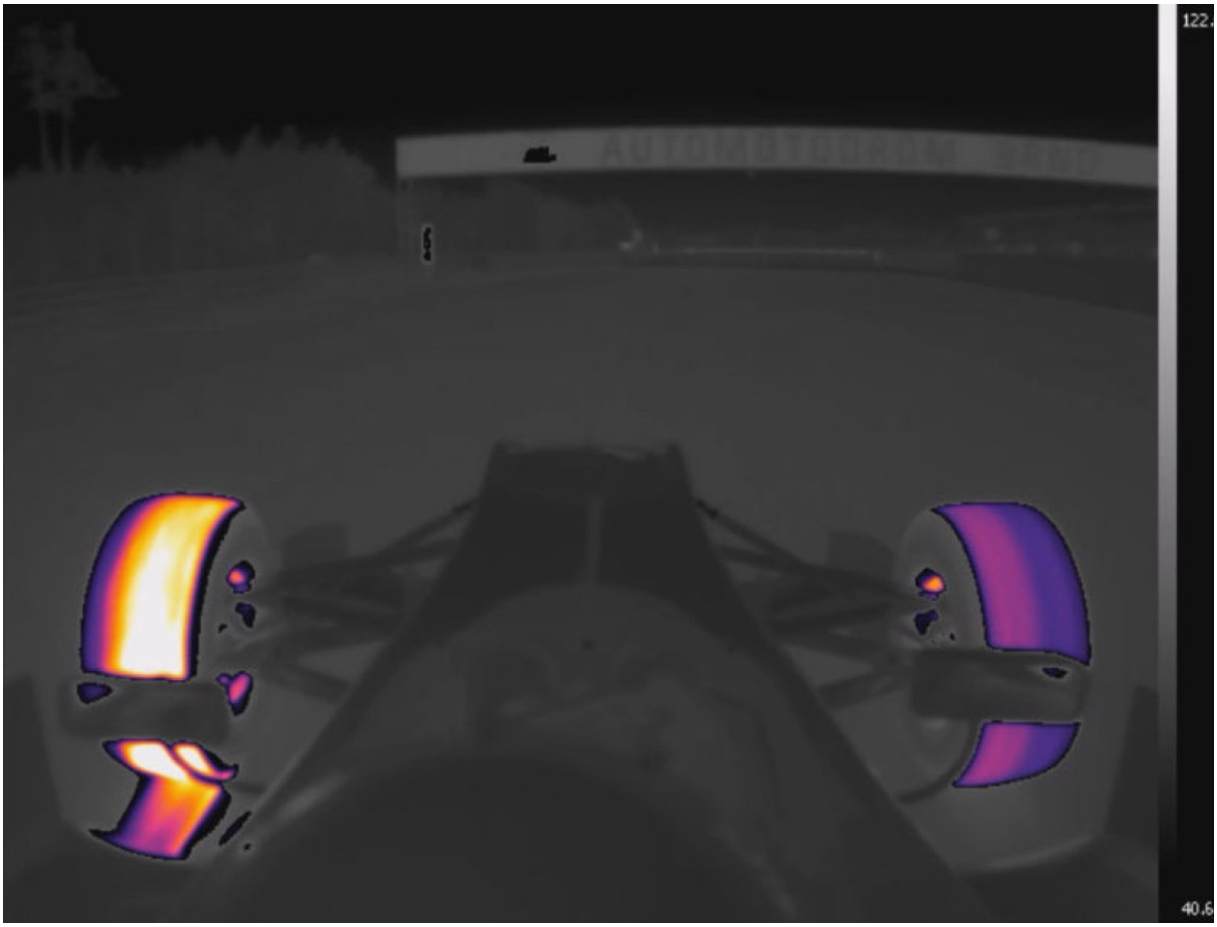

Image #2: Figure 2: Heat generated by "weaving" and braking

"*Driving a car as fast as possible is all about maintaining the highest possible acceleration level in the appropriate direction*" Peter G. Wright, Technical Director, Team Lotus

As the link between a vehicle and the road, the tire ultimately determines the performance that can be realized for a race car. On a modern Formula race car, profile less "slick" tires are used that need to be in a specific temperature window for ultimate performance. Up to a certain temperature, a higher surface temperatures will generate more grip but above a certain temperature the grip levels will drop. Furthermore the temperature of a tire can be differentiated in a "core" temperature -the temperature of the internal construction of the tire- and a surface temperature. The main objective is to reach the optimum core- and surface temperature of a tire before the driver starts a quick lap. On very cool days a driver might struggle to bring the tires up to optimal operating temperature, while on hot days the tire is already overheating before a quick lap is completed. As a result tire warming strategies will change with different ambient- and track conditions.

In all junior formula series it is by regulations forbidden to show the driver the actual tire temperatures on the dashboard while driving. As a result drivers need to get a feeling for tire warming during test days. The possibility to give the driver visual feedback on the tire warming procedure has proven to be very effective.

The example below shows some footage of the warm up laps during a test on a very hot summer day. During the test surface temperatures of the tires rose above their maximum value within 2 consecutive fast laps. As an experiment the driver was asked to make sure that during the first laps on new tires, the core of the tire was brought up to temperature while surface heating was kept to a minimum. To do

this, the driver made sure that the lateral acceleration was kept well below its maximum by moderate “weaving” on the straights. Furthermore the brakes where applied in an effort to use the radiated heat of the discs for the purpose of heating the core of the tire.

Studying the footage of the thermal camera however showed that by using this strategy, the opposite effect was sorted. The weaving on the straight unloaded the inside front tire and with the brakes applied the inside tire started to “under rotate”. This excessive amount of slip actually generated a lot of temperature on the surface of the tire. By showing this information to the driver, the driver could easily optimize the tire warming procedure.

Technical Adaptations by TeAx

A regular ThermalCapture 2.0 640 has been used in the environment of the client, which is a Formula 3 racing car. A special protection for the thermal lens was created in order to protect it against stone-chipping events. Some other slight modifications have been made, but can’t be discussed publicly.

Testimonial

The Thermal Capture 2.0 has helped us better exploiting the potential of our racing tires and so improved the performance of the race car. From the first contact, until final implementation and operation, TeAx has always been very supportive to help making the right decisions, as well as providing support and solving any issues that occurred in our specific application.

Keywords for this case study

Formula 3, Racing, Tire warming with thermal cameras,

Contact details

Contact Person	Michael Thoss, VP Sales & Marketing at TeAx Technology UG
E-Mail | Twitter | Mobile	thoss@teax.de | @michael_thoss | +49-151-2754-9117
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