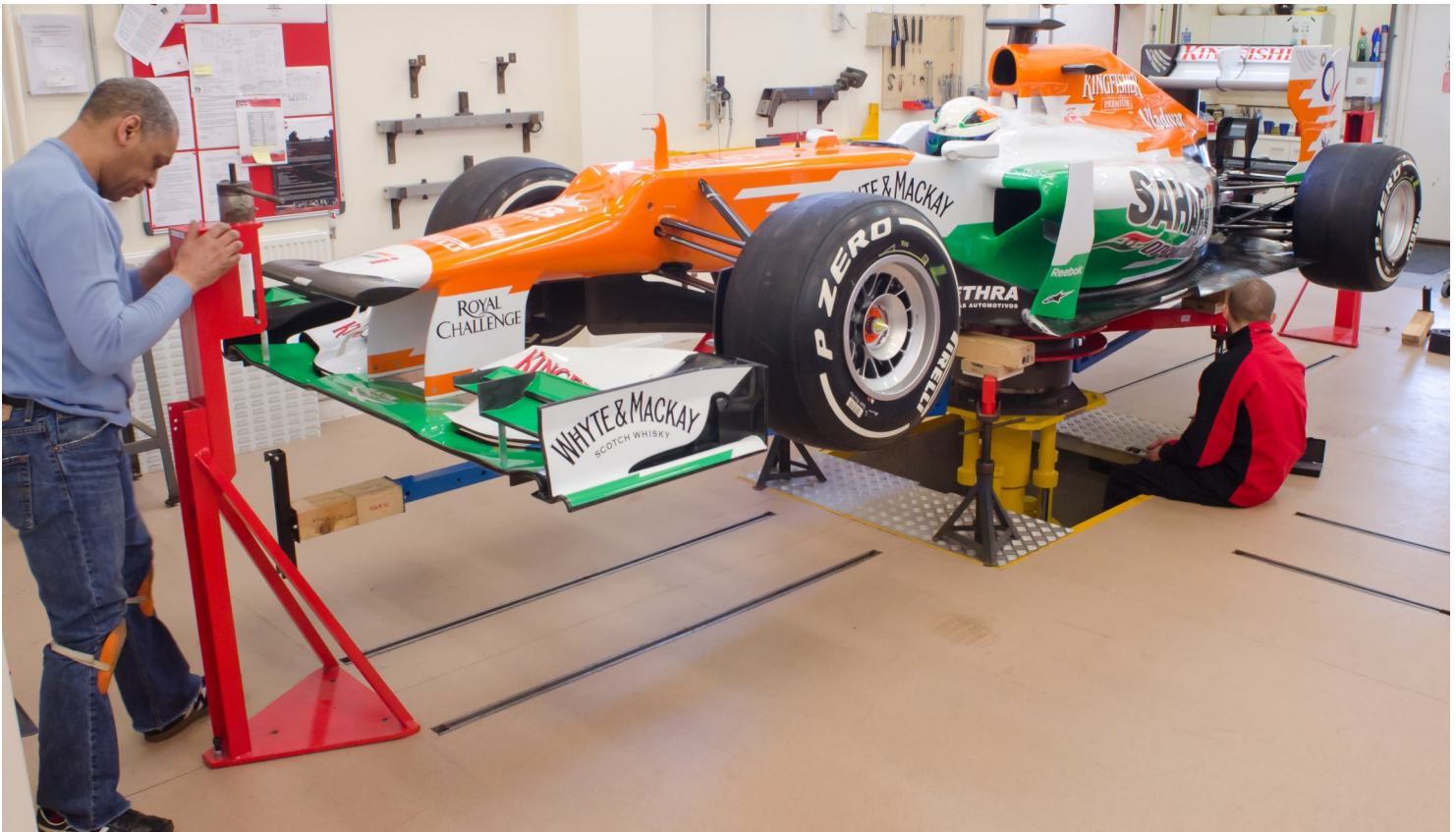


Cranfield Impact Centre Moment of Inertia Test Software

Utilising National Instruments LabVIEW and modular DAQ hardware

Simplicity AI developed a sophisticated measurement and analysis application



ABOVE:
The moment of inertia facility at Cranfield with a formula-One car in position

The Challenge

Cranfield Impact Centre is a UK based organisation which is internationally respected in the field of vehicle crashworthiness and analysis. One of their key test laboratory facilities is a 3-axis moment of inertia/centre of gravity measurement platform, which can be used to test components such as transmissions, or complete vehicles including Formula One cars.

Simplicity AI were tasked with providing a new application for carrying out moment of inertia measurements, completely replacing a legacy solution. The software is required to perform data acquisition from sensors within the test rig, then process the data, performing over 150 calculations to produce the required results. There are only two main types of test performed but each one is

performed under different rig orientations and they are all repeated multiple times to ensure best measurement accuracy. The software must log and display all the data from the repeated tests and allow the user to remove any spurious results to ensure the best quality analysis.

“The LabVIEW application developed by Simplicity AI has greatly accelerated the process of evaluating moments of inertia and centre of gravity of a vehicle”

Dr James Watson

Senior Safety Engineer, Cranfield Impact Centre

The Solution

Products & Services Delivered

- ✓ LabVIEW Development
- ✓ DAQ Programming
- ✓ Custom Acquisition Enclosure
- ✓ Telephone, email and remote support
- ✓ On-site Installation

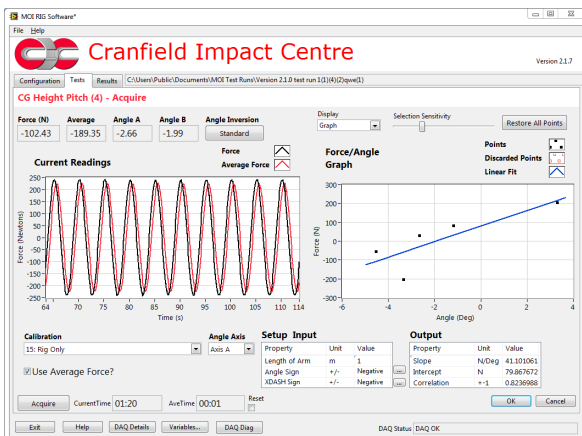
The software was required to perform extensive mathematical calculations on the data it acquired. Additionally there was a need to verify that these equations were correct, both for the commissioning phase and the commercial operation of the software. To satisfy this the system was designed to load the equations from a text file and execute them using LabVIEW native formula processing functions. This allowed the engineers to easily verify that the equations were correct without having to understand the LabVIEW code.

```

equations.txt - Notepad
File Edit Format View Help
name Computational Variable Equation Variables
VehiclePropMT MT MFL+MFR+MRL+MRR "MFL,MFR,MRL,MRR"
VehiclePropMFT MFT MFL+MFR "MFL,MFR"
VehiclePropMRT MRT MRL+MRR "MRL,MRR"
VehiclePropXBAR XBAR (MFL+MFR)*WB/MT "MFL,MFR,WB,MT"
VehiclePropXBARF XBARF XBAR-WB "XBAR,WB"
VehiclePropYBAR YBAR ((MFR-MFL)*TF/2+(MRR-MRL)*TR/2)/MT
ObjectPropMT MT MF+MRL+MRR "MF,MRL,MRR"
ObjectPropWB WB YNMRL+YPMRR "YNMRL,YPMRR"
ObjectPropXBAR XBAR (MF*XYMF+MRL*XYMRL+MRR*XYMRR)/MT
    
```

User Interface

The application user interface was designed to be as flexible as possible. Live data and previous measurements are displayed alongside each other. Current test results can easily be compared to previous runs to ensure data collection is accurate. Individual tests and individual measurements can be disabled from the calculations to remove any spurious results without the requirement to repeat



TOP LEFT:
Equations text file

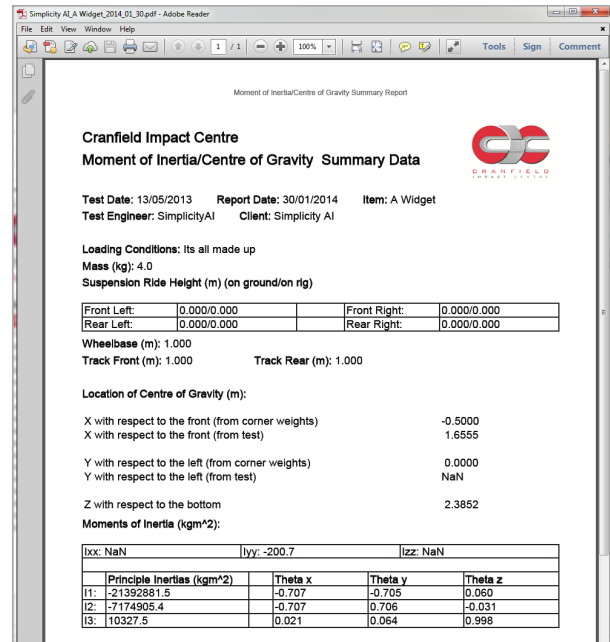
LOWER LEFT:
User interface for Centre of Gravity tests.

RIGHT:
Final report format

all the tests. Tests can also be repeated, reviewed and parameters changed without losing data.

Reporting

Simplicity AI used their 'Custom PDF Generator' to format the result of the test into a document that can be presented directly to the customer. Automatic generation of this report have greatly decreased the amount of time required to provide test results to customers.



Upgrades and Long Term Support

The application continues to be extended beyond its original capabilities. Software updates have been provided by Simplicity AI in a mix of electronic delivery and onsite installation. Support for different axis of measurement were added along with advanced Eigen value calculations that previously had to be computed in an external application. One of the additional requirements was a 'second screen' that could display levelling information when setting up the rig. Simplicity AI leveraged the National Instruments Data Dashboard for iOS to provide a simple remote screen for displaying levelling information. This was implemented successfully within a few minutes and allowed the technicians to set up the test rig without having someone in front of the PC calling out instructions.