

MIRA

AERODYNAMICS RESEARCH

MIRA USES VICON MOTION CAPTURE TO STUDY AIRFLOW VISUALIZATION WITH 3MM BUBBLES AND INCREASE FUEL EFFICIENCY



“MIRA CHOSE TO WORK WITH VICON’S T-SERIES CAMERAS BECAUSE OF ITS UNIQUE MIX OF HIGH RESOLUTION, FAST CAPTURE RATES AND PROVEN MOTION TRACKING ABILITIES. DATA THAT USED TO TAKE US MONTHS TO GATHER AND ANALYZE, NOW TAKES AN AFTERNOON.”

ANGUS LOCK



For over 40 years British automotive test company, MIRA, has been recognized as a leading independent product engineering, testing consulting and certification organization. It strives to deliver new vehicle systems and components by integrating innovative design and simulation techniques, which are validated in over 30 major test facilities.

Operating across a range of transport technologies MIRA provides particular expertise in vehicle safety, aerodynamics, thermal management, NVH (noise, vibration and harshness), EMC (electromagnetic compatibility) engineering, power train integration, environmental engineering and all aspects of durability.

MIRA's engineers thrive on diverse and technically challenging projects; they're always able to offer an innovative approach or solution for its customer base, which includes major vehicle manufacturers, systems and component suppliers and other independent consultants throughout most of the vehicle-producing world.

THE CHALLENGE

Car manufacturers increasingly look for ways to improve the efficiency of their vehicles. Making a car more aerodynamic has many benefits. For example, it improves fuel efficiency, making the vehicle greener, and it will enable the car to travel faster; particularly useful if you're a Formula 1 driver!

Angus Lock, head of Aerodynamics at MIRA said, "Fuel efficiency is now more important than ever. Our customers are leading the way, ahead of the 2012 EU guidelines requiring all new cars to reduce CO2 emissions to 130g/KM. The problem is, the current analysis methods either don't offer us enough detail or they take months to complete."

Always looking for a challenge, the engineer's at MIRA started looking to improve the efficiency of current airflow visualization – a technique

used to improve the aerodynamics of a vehicle by monitoring the airflow around it. However, drag reduction techniques are notoriously slow and time consuming: the most common methods include Particle Image Velocimetry (PIV), which is limited to a single plane, tomographic PIV or Particle Tracking Velocimetry (PTV), which is limited to academia and small volumes.

In 2005, MIRA started to look into a new visualization method called bubble tracking, using 3mm helium filled bubbles. These bubbles are pumped around the rear of a vehicle in a full-scale automotive aerodynamics wind tunnel to give an accurate display of air flow. Previously, it's always been a fairly manual process, limited by very small capture volumes and the labor intensive task of processing the data.

Lock hoped to track the bubbles using technology more commonly found in a hospital: motion capture. Lock realized, because of the near transparent nature of the bubbles, the speed and the seemingly random way they move around the volume, he needed a highly accurate system that would be sensitive enough to track each bubble in the 3mx2mx2m wind tunnel to give him accurate, precise airflow data.

THE SOLUTION

MIRA worked with Vicon to win funding for the project from the Department of Trade and Industry (DTI). The two companies conducted preliminary research to prove that a Vicon motion capture system could see and track a soap bubble.

Andy Ray, EMEA Sales Manager at Vicon said, "Angus came to Oxford with the bubble machine and we tested it in our studio. Our first attempt was successful! It was fantastic to see, in real time, the bubbles being tracked and moving across the screen. We didn't even need to chemically alter the soap solution."

Seeing the successful results of the project, the DTI awarded MIRA funding to complete its

bubble flow visualization technique, including the purchase of a 12 camera T40 motion capture system.

THE RESULT

Several high profile car manufacturers and two Formula 1 teams have already successfully used the innovative airflow visualization technique. Lock explains, "Measuring the precise location of hundreds, even thousands of helium filled bubbles gives our clients valuable velocity information, and they're able to build up a picture of what the flow is doing around the car."

"The continual technical support from Vicon helps us exploit the T-Series' class leading technology in a completely new application area, as well as rapidly getting to grips with the capabilities of the system. Our technical partnership with Vicon means we can continue to deliver a truly world class aerodynamic flow visualization technique."

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