Wind Power

Gaining access to the full scale wind tunnel at MIRA is a rare thing for a kit car manufacturer. But via the Niche Vehicle Network that's exactly what several specialist manufacturers managed. CKC joined MEV to see what can be learnt.

MIRA is the place mainstream manufacturers take their prototypes to be poked and prodded... no wonder that the security gates are well manned and anything resembling a camera is viewed with the same level of threat as a primed AK47. Tricky then for a car magazine to bring in bags of potentially incendiary devices! Prior emails meant CKC was met at the gate and all offending items were handed over and driven in a separate van directly to our destination in the facility's full-scale wind tunnel. All mobile phones have a tamper-proof sticker placed over the camera lens and, finally, we are allowed to pass.

MIRA stands for Motor Industry Research Association and was originally a government funded organisation when established in the 1940s. Today it's an independent test facility owned by Japanese supplier of measurement technology, Horiba. The MIRA Proving Ground offers a wide variety of testing facilities aimed at motorised vehicles. So from noise tests, ride and handling circuits to wind-tunnel testing, it's all done here. And it's busy... as we drive from the security gate to our destination there are cars racing around the banked circuit, prototypes covered in sheets being unloaded off trucks,

Below: MEV Exocet being rolled into position.

Below: Adjusting the measuring plates prior to rolling car into precise position.

Above: Motor Industry Research Association was formed in the 1940s.

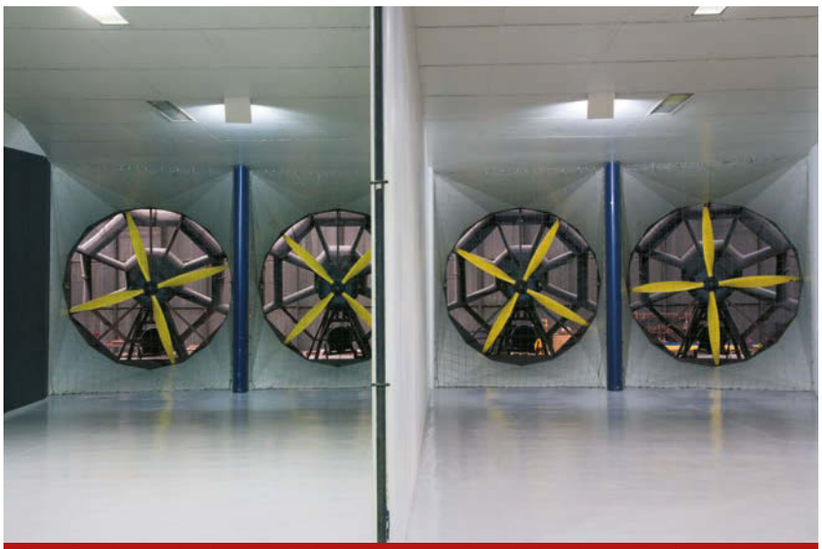
military vehicles and top end luxury cars going in all directions. And outside the wind tunnel is an Exocet being unloaded by Mills Extreme Vehicles.

As you'd expect, any form of testing at MIRA does not come cheap, and MEV is here as a consequence of its recent membership of the Niche Vehicle Network (see separate panel). The group has booked two days of wind tunnel testing which have been chopped up into two-hour chunks for the benefit of a number of its members. Without saying who they are, various familiar low volume turnkey manufacturers are taking advantage of the opportunity, as well as a select few from the kit car scene.

Once inside the facility we are reunited with the camera kit, as Stuart Mills and Julie Wilson from MEV bring the Exocet in and the MIRA team begin the process of setting the car up in position. Located on plates that measure a variety of different forces, precise positioning is critical if the resulting figures are to mean anything. It doesn't take long though, and the MIRA team are aware that, regardless of how big the company bringing in a car, the cost of the testing means that time is everything. They work swiftly and efficiently.

MEV is organised too. The Exocet isn't just here in standard form. Stuart has developed front and

Below: New windscreen and frame gaffer taped in place.



Above: Propellers are located behind the test vehicle, puling air over it rather than pushing from in front.

rear wings for the car, along with a full windscreen (which arrived this morning and was fitted courtesy of gaffer tape just before it was driven into the wind tunnel!). Stuart is keen to see if the wings offer any genuine advantage in terms of downforce and what effect the screen might have. But he's also realistic. The Exocet has always handled well and is a great road car. Driven on the road at legal speeds, can the new appendages really offer any tangible improvement? He remains to be convinced.

The Exocet starts the test with everything in place and the aim is then to repeat the procedure with different components removed or relocated. As you'd expect, the figures produced from a run are copious but the main ones we are interested in (and can understand!) are ones for front and rear downforce (or lift) and drag. But the wind tunnel also provides figures for roll, yaw, pitch and lots of other parameters.

First thing we'd not expected is that the four massive propellers that generate the wind are behind the car and not in front of it. Of course, it's completely logical, as air is pulled over the car, with it first being drawn through honeycomb style 'flow straighteners' to ensure a clean flow of air over the vehicle. We are ready to go...

RUN ONE

Rear wing: Fitted – position high
Front wing: Fitted
Windscreen: Fitted
The test itself is quick, taking no more than five minutes. Two sets of data are accumulated in this time to help offset any anomalies.
Result: This is our benchmark, with the aim being for the final test to have everything removed, so the car is back to its 'standard' form. As expected, the Cd drag figure (.682) is very high compared to a modern production car, but no one is claiming the Exocet is an especially aerodynamic shape. More interesting are the front and rear

Below: Dummy mannequin located in the driver seat.

downforce figures with the wings in place. At the front there's a modest degree of lift (something that most roadgoing cars would demonstrate), while at the back there's a useful degree of downforce.

RUN TWO

Rear wing: Removed
Front wing: Fitted
Windscreen: Fitted
Result: As expected, taking off the rear wing reduces the downforce significantly, but the drag is also down slightly, while front end lift gets a little more pronounced.

RUN THREE

Rear wing: Fitted – lower position
Front wing: Fitted
Windscreen: Fitted
Result: Stuart has designed a lower position for the rear wing, behind the rollover bar and seats. He thinks it will be very inefficient here compared to the higher location where it has cleaner air. As expected, there's a small degree of downforce, but only a fraction of what was present before with the wing in its high location. All show, no go!

RUN FOUR

Rear wing: Fitted – lower position
Front wing: Removed
Windscreen: Fitted
Result: With the front wing removed from the Exocet, the existing lift is made noticeably greater. No great surprises there. But the drag figure is slightly worse, showing that the front wing actually cleans up the airflow slightly over the front wheels.

RUN FIVE

Rear wing: Fitted – high position

Front wing: Fitted
Windscreen: Removed
Result: Now it's time to see what the wings do on their own, with the windscreen removed. With the rear wing back in its high location rear downforce jumps back up significantly, but front end lift also increases, a sign that the windscreen is adding downforce over the front wheels when in place. Drag is also up, with the loss of the screen making the Exocet less slippery through the air.

RUN SIX

Rear wing: Removed
Front wing: Removed
Windscreen: Removed
Result: Final run of the day, with the Exocet now back to its standard layout. With no wings or windscreen to increase the drag, the Exocet is now its slipperiest through the air, although the Cd figure of .598 is hardly groundbreaking. More interestingly, rear downforce is almost down to nothing, the car neutral over the rear axle. Up front, the lift that has been a feature for the duration remains.

CONCLUSION FROM THE RUNS

It's been a fascinating two hours. In standard guise, the Exocet has a small degree of rear downforce but suffers from front end lift. Adding the front wing has provided the greatest single benefit, and the team at MIRA instantly suggest that if it was mounted lower (which it could easily be), then its impact would be greater still and quite possibly eliminate any traces of lift altogether.

Less surprising has been the rear wing, which worked well in the clean air of its higher location, but was largely ineffective in its lower location. If you want a wing on your car, get it into the clean air if you want it to be anything more than a styling exercise!

Of more interest was the effect of having the new screen in place. It not only increased the front end downforce slightly, but also improved the car's efficiency through the air.

And perhaps it shouldn't be a surprise that removing any one of these three elements not only had an effect in the area where it was removed, but also on the other areas around the car. So a big rear wing

Niche Vehicle Network

The Niche Vehicle Network (NVN) was formed around ten years ago by Advantage West Midlands as a regional pilot scheme and it has subsequently grown to a national network covering the whole of the UK. It's currently funded by a number of UK Government departments, including Innovate UK, the Office for Low Emission Vehicles and the Department for Business Innovation and Skills. This allows it to offer free membership to companies active within the niche and low volume vehicle manufacturing sector.

As a group, the NVN aims to provide grant funding and support to enable member companies to research, develop and use new technologies to form the basis of their new vehicle models.

Joining the NVN not only enables members to access potential funding, but also increase their knowledge of potential suppliers and gain an appreciation of how innovation can assist the growth of their company. Access to facilities such as the MIRA wind tunnel are other obvious benefits. W: www.nichevehiclenetwork.co.uk

Below: Health and Safety guidance for the wind tunnel, not for tea and biscuits!

Above: Screen disturbs air to rear wing but creates downforce itself.

Above: In the cockpit eddies are plainly evident.

Above: Air clearly drawn from behind car forward again.

Below: Stuart and Julie from MEV make regular changes to the car between runs.

Above: Even in an exoskeletal car, air movement in the cockpit is very different to what you might expect.

Above: Theory of downforce perfectly illustrated.

might increase downforce over the rear wheels, but because it's pushing the car down at the back, it can actually increase lift at the front end.

WHAT NEXT

Having thought there would be few surprises from the runs in the wind tunnel, Stuart Mills has been fascinated by the results. He's obviously delighted with the front wing he's created and is already planning a tweak to the nosecone that will allow it to be located in a more optimal lower location. He's also delighted with the addition of the windscreen, which not only appears to have dynamic advantages, but also looks great too! As for the rear wing... it'll be on the Exocet options list, but is by no means a priority.

Indeed, it's important to remind ourselves that we've always been hugely entertained by the Exocet's engaging and predictable handling. With its MX-5 based mechanicals, that's hardly surprising, and even at fast road speeds we've never felt the car to be lacking in front end grip. Far front it. Stuart's new optional additions to the model offer potential dynamic improvements to an already impressive product. If you are heading trackside, then these will be of even greater value, but for most road users they'll remain an intriguing option, we suspect more often inspired because of the styling statement they make, over any handling improvements. And why not?

SUMMARY

The Niche Vehicle Network should be applauded for enabling small scale manufacturers to benefit from such technology and while it might be easy to suggest it's hardly relevant for companies within our small industry, each and every company should be striving for improvement and taking advantage of such opportunities when they arrive. MEV, like every other small and large company leaving the MIRA facility over the two days the Niche Vehicle Network has booked, leaves with not just a pile of facts and figures, but a greater understanding of its product and how it can be tweaked for the future. For us as end users, that can only be a good thing.

CKC would like to thank the Niche Vehicle Network for facilitating our involvement in these tests.

Contacts

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Test results

TEST	SET-UP	Cd (DRAG)	FRONT DOWNFORCE/LIFT	REAR DOWNFORCE/LIFT	CONCLUSIONS
1.	Everything fitted, rear wing high	0.683	0.029	-0.148	First benchmark, slight lift at the front and some downforce at back.
2.	Rear wing removed	0.638	0.032	-0.016	With rear wing removed, the drag figure is down slightly, but rear downforce significantly reduced.
3.	Rear wing in lower position	0.640	0.033	-0.065	Rear wing in its lower position offers a slight downforce improvement
4.	Front wing removed, rear wing low	0.670	0.231	-0.079	Drag figure increased slightly, but front end lift noticably higher
5.	Screen removed, wings on/high	0.717	0.279	-0.453	With the screen removed, the high rear wing really delivers downforce
6.	Everything removed	0.600	0.389	-0.090	In 'standard' form, Exocet naturally has some front end lift and small amount of rear downforce