

UKAAF Briefing - Wind Tunnel Investment

Contacts: Andreas Kremheller (UKAAF chair)

Andreas.Kremheller@ntc-europe.co.uk

Professor Martin Passmore.

m.a.passmore@lboro.ac.uk



Introduction

This briefing, prepared by the UK Automotive Aerodynamics Forum¹, outlines the need for Automotive wind tunnel investment in the UK. It forms one component of a broader strategy to ensure that the UK meets the challenges and identifies the resources required to deliver internationally leading vehicle aerodynamics in the UK. The broad vision is to protect and expand high value R&D jobs, build world leading aerodynamics capability and to make a major contribution to the competitiveness of the UK Automotive industry.

The importance of vehicle aerodynamics is recognised by its specific inclusion in three of the Automotive Council's technology roadmaps published in 2013; *Passenger car low carbon technology*, *Commercial and off-road technology* and *Motorsport technology*. The UK Aerodynamics community is vibrant and has an internationally leading profile. It has the capability to make a significant contribution to delivering growth and sustainability in the UK Automotive Sector.

The Role of Vehicle Aerodynamics.

Aerodynamic drag – Fuel consumption

A 10% reduction in drag gives 1.5-2.5% improvement in fuel consumption. (source NEDC).

In real world driving 10% reduction in aero drag gives 2.5-4.0% improvement in fuel consumption. (source BMW)

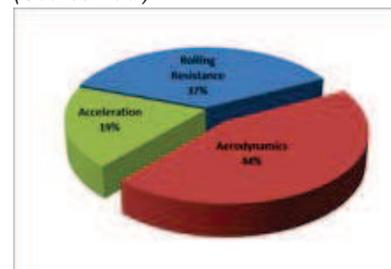
The aerodynamics of passenger cars is a central part of the vehicle product development process and a vigorous area of research for OEM's, suppliers and Universities. Vehicle aerodynamic performance has its roots in the contribution it makes to the overall vehicle energy consumption particularly with vehicle drag reduction playing a major and

direct part in reducing CO₂, but also in increasing range and reducing the required battery mass in EV's and hybrids. The introduction of the technologies identified in the Automotive Council's roadmaps, particularly low-carbon, lightweight vehicles, increases the relative importance of the

aerodynamic drag in the overall vehicle energy consumption. However, in addition, the light-weighting agenda also brings new challenges in

Technology

The addition of regenerative braking alone increases the contribution of aerodynamic drag from less than a third of the vehicle losses to 44%. (Source Audi)



Real-World use

In real customer use aerodynamic resistance increases from under a third (NEDC) to 48% of the vehicle losses. (source Audi)

crosswind and high speed stability, external and internal noise etc. These safety and refinement areas are of paramount importance to delivering a competitive UK automotive sector.

Legislative background

The World-Harmonized Light-Duty Vehicles Test Procedure (WLTP) and its drive-cycle (WLTC) is due for introduction in 2017. This new approach places more emphasis on the use of moving-ground wind tunnels in the homologation process and will generate significant new demand across the whole of Europe that cannot be met with the existing facilities. The increased demand includes the need to test many model variants to establish specific CO₂ figures.

In addition to the currently proposed legislative framework the prospect of further changes to capture 'real world' emissions and economy and to restore public trust in the testing procedures is a real possibility.

Current wind tunnel access.

The UK is the only major European country active in automotive research and product development that does not have a full scale moving-ground or aero-acoustic wind tunnel facility. In 2012 the UK accounted for 10% of EU car production (source: ACEA), by comparison:

- *Germany*, 37% of car production, *six* facilities: Audi [1998], BMW [2009], Daimler [2013], Porsche [2014], and FKFS/University of Stuttgart [upgrade 2014], Ford of Europe (upgrade 2017)
- *France*, 11.5% of production, *one* facility: The Renault / PSA / CNAM consortium, S2A [2003]
- *Italy*, 2.7% of production, *two* facilities: Pininfarina S.p.A. [2006], Fiat [upgrade 2017].
- *Sweden*, 1.1% of production: *one* facility: Volvo [2006]

Comparable facilities also exist widely outside Europe, including *USA*: Windshear; GMAL [upgrade 2016], *Canada*: National Research Council [2009]; *Japan*: Honda [2010], Railway Technology Research Institute [1996], Toyota [2013]; *China*: Shanghai Automotive/Tongji University collaboration [2009]. There are also many others in planning.

UK based manufacturers are currently spending about **£3.8million** (per annum) hiring moving ground and aero-acoustic facilities outside the UK and a further **£0.75 million** (per annum) on travel and associated costs. The predicted increased demand for wind tunnel time will ensure that costs will rise significantly and the likelihood that there will not be sufficient capacity for the UK's needs will put the competitiveness of the UK automotive industry at risk.

Investment.

There is a simple and compelling case for investment in the UK's wind tunnel infrastructure. It is not the objective of this briefing to suggest a particular specification but a National capability is essential that satisfies the full-scale MGP requirements of WLTP, the needs of OEM's full-scale aerodynamic and aero-acoustic development, future research challenges, including unsteady and real world aerodynamics and future advanced transportation systems.

[¶]The UK Automotive Aerodynamics Forum, initiated in 2012, brings together and promotes product development and research activities in automotive aerodynamics and aero-acoustics. Forum meetings are open and include representatives from academic institutions, all UK OEMs, Motorsport and consultancies.
<http://www.aero-forum.co.uk/>