



High Efficiency Selective Catalytic Reduction Project

Professor Graham Hargrave
Loughborough University



Loughborough
University

Heavy Duty Vehicle Efficiency Programme: High Efficiency Selective Catalytic Reduction Project

Professor Graham K. Hargrave

Professor of Optical Diagnostics

Royal Society Wolfson Research Fellow

.....
#InspiringWinners since 1909

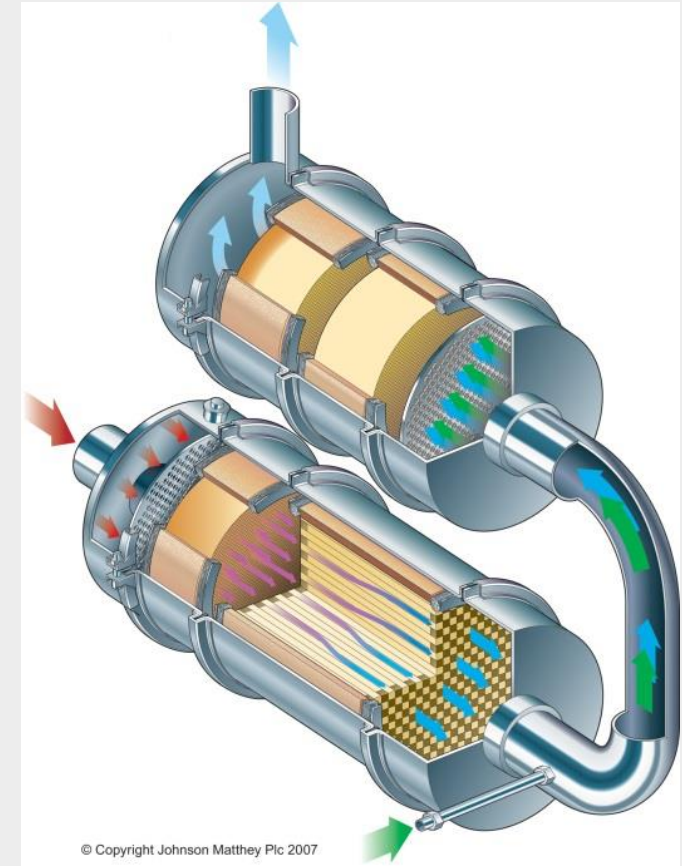
High Efficiency Selective Catalytic Reduction Project

The objective of the project was to deliver a Selective Catalytic Reduction system capable of **>98% NO_x reduction** to enable engines with high thermal efficiencies to meet regulated NO_x emission levels.

A collaboration between, Johnson-Matthey, Caterpillar and Loughborough University.

Loughborough's Role:

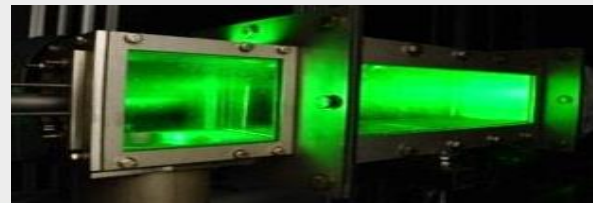
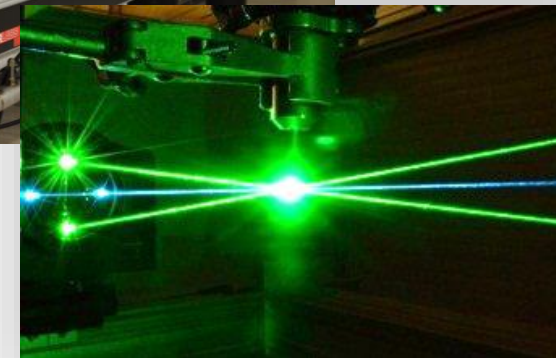
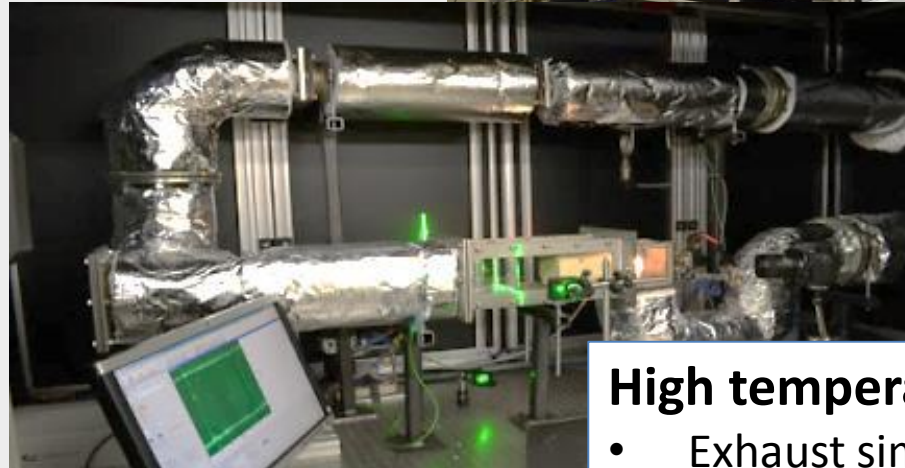
- (1) Development of **new reductant dosing system** to achieve the technical objective of >98% NO_x reduction.
- (2) Develop **improved CFD design tools** to allow redesign and optimisation reductant dosing systems validated on a gas flow rig and on the testbed engines against real world cycles



Facilities and Methodologies Established for the ETI Project

In this highly successful project, Loughborough University achieved its goals through the application of **state-of-the-art optical diagnostic** techniques to understand the **fundamental physics and chemistry** of the NOx reduction technology to allow the design of a **world-beating technology**.

Loughborough University developed **novel CFD modelling tools** capturing the knowledge and data gained during the experimental programme to define **new design tools** for the next generation ultra-low emission diesel engines.



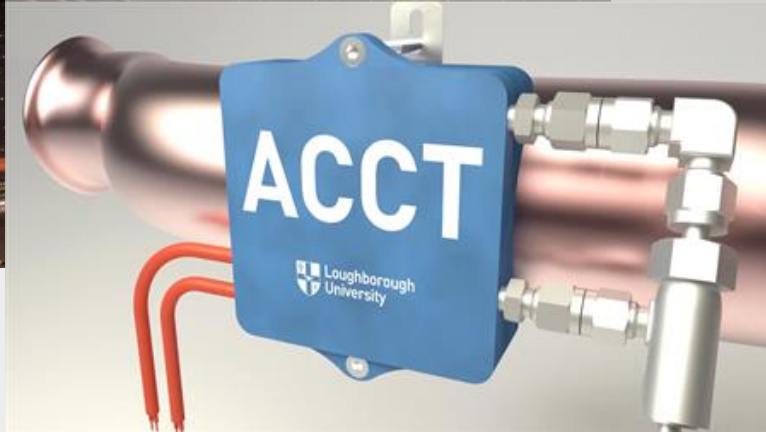
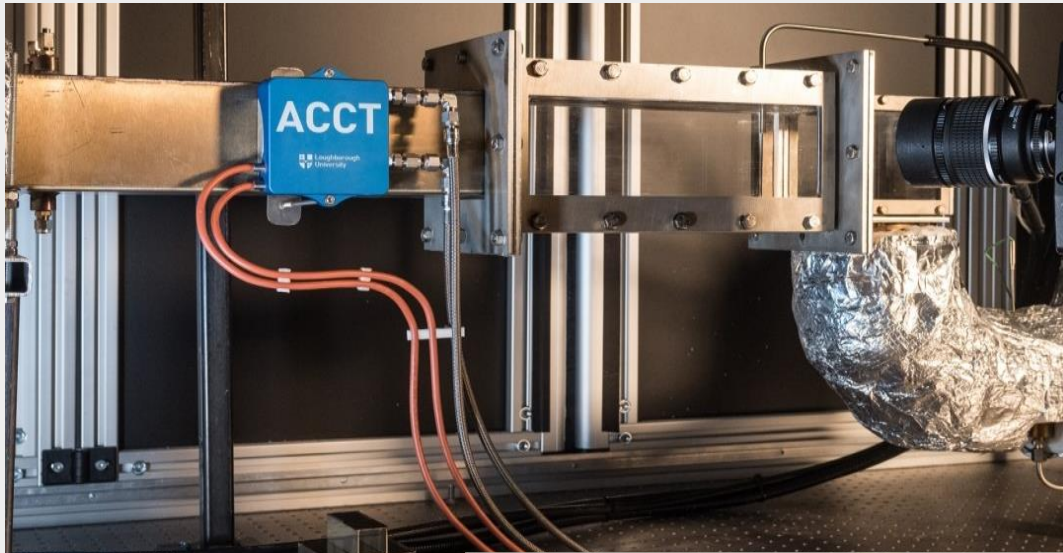
High temperature flow facilities:

- Exhaust simulation up to 15 litre engine
- Ambient - 600°C
- Up to 1500 kg/h flow rate
- Fully optically accessible

Long Term Outcomes from the Project

- Significant knowledge and understanding about engine after-treatment analysis and design was gained and is being applied to new engine designs,
- New state-of-the-art experimental facilities for after-treatment systems which are now being used to develop emission reduction systems for new engines as part of an Advanced Propulsion Centre project,
- New modelling tools are being used for a range of applications including engine analysis,
- Two new PhD researchers were trained through the ETI project. These highly trained research engineers are working on APC projects and within the automotive industry.
- The project won The Engineer 'Collaborate to Innovate' Awards in 2017

New NOx reduction technology: ACCT



A problem with current SCR NOx reduction systems is the ability to make ammonia during cold start and **low temperature exhaust conditions**.

Loughborough has developed a new device called ACCT that on-engine converts AdBlue™ into a new solution.

- The new solution is stored and dosed where AdBlue will not decompose
- Provides ammonia **from 50°C**
- **Adds on to the existing AdBlue™ delivery system** and requires no additional pumping units.
- The system is **fully scalable**.
- The ACCT system will **not develop deposits**.