SPECTRE: Single-Cylinder Portable Electronically Controlled Thermodynamic Research Engine.

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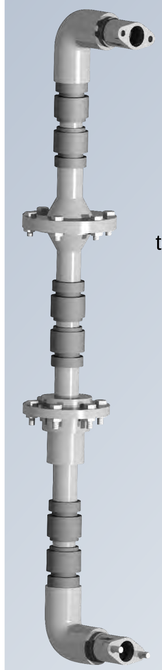
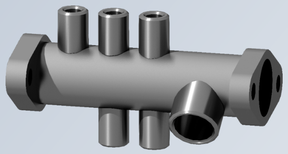
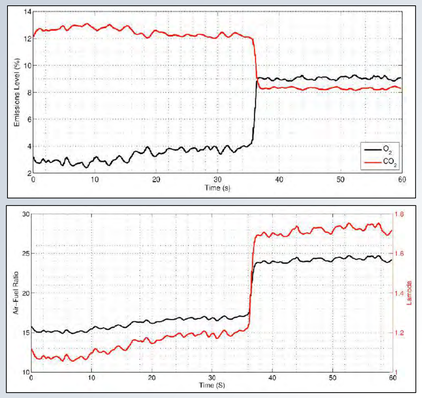
UCL

Emissions Analysis





Custom engineered exhaust manifold housing a gas analyser, and sensors measuring: lambda, pressure, and temperature, along with a device (Left) designed to capture gaseous and solid carcinogen particulates.



Graphs showing the capability of the exhaust system to monitor emissions (Upper) and the effect of varying throttle position (Lower).

Context

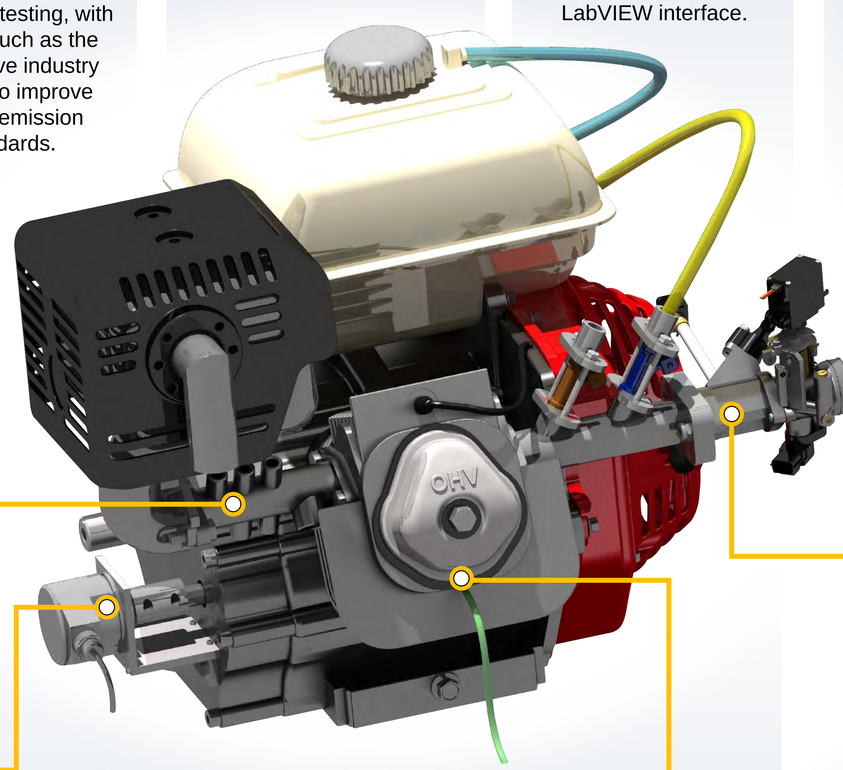
Commercially available research engines are used by academics and industry professionals to provide insight into optimal engine operating conditions. They are important for emissions testing, with sectors such as the automotive industry striving to improve engine emission standards.

Problem

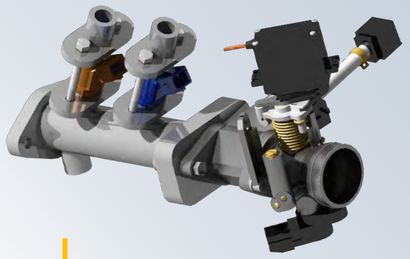
Typical research engines are expensive, highly complex, and lack portability, making them inaccessible for many people. Many schools lack the infrastructure and funding to support full-scale devices, which can retail for upwards of approximately £250,000.

Solution

Our solution provides a modular, fully-instrumented device, capable of performing typical combustion, ignition and exhaust analyses. All in a compact form-factor, supported by the LabVIEW interface.

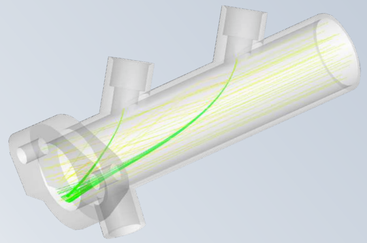


Fuel Injection



Newly designed intake manifold supporting a dual injector layout and modified throttle body to electronically vary air-fuel ratio during operation.

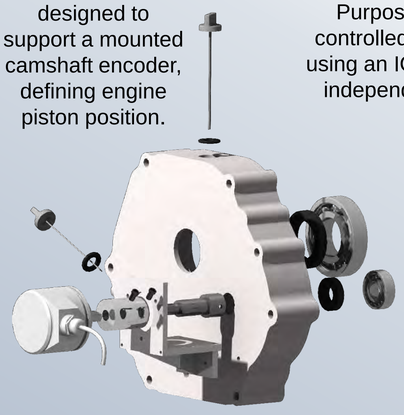
Engineered from CFD analysis, targeted at investigating the fuel spray behaviour to minimise wall wetting.



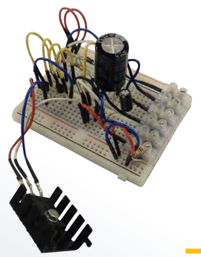
Implemented electronically controlled throttle, driven by an Arduino board interfaced with LabVIEW.

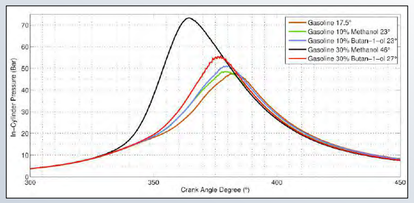
Systems Control

Re-engineered crankcase cover designed to support a mounted camshaft encoder, defining engine piston position.



Purpose-built electronically controlled spark ignition system using an IGBT focused circuit, for independent spark discharge.

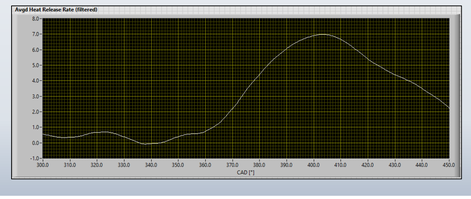


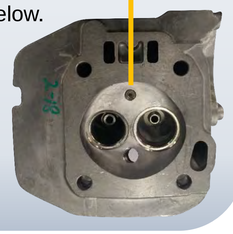


Spark control allows for the analysis of engine knock and achievement of optimal engine performance.

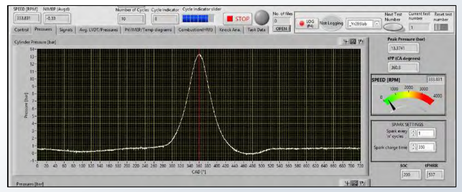
Combustion Characteristics

In-house modified cylinder head featuring a flush mounted pressure transducer, providing data for combustion characteristic analysis, such as heat release rate seen below.





Data Acquisition



Dynamic data acquisition using LabVIEW to display and log engine combustion characteristics, such as in-cylinder pressure.

Streamlined graphical user interface allowing for complete control of spark and injection timing, and throttle position.