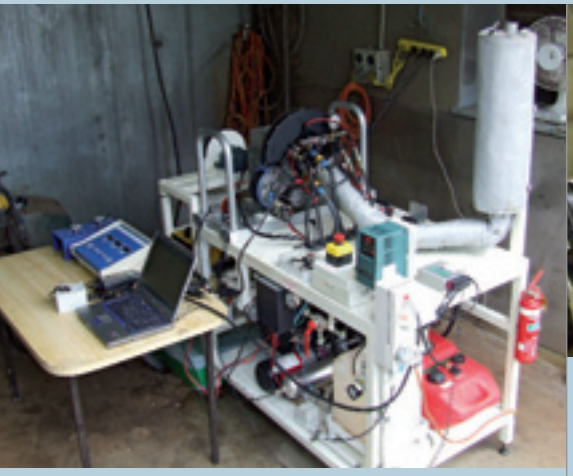
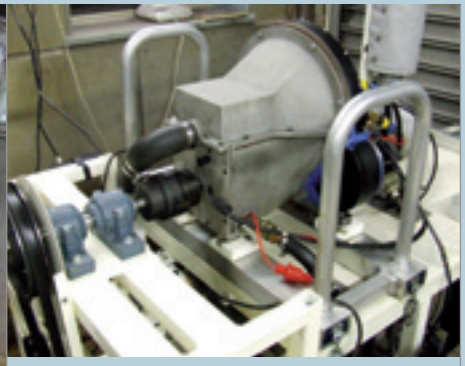
Different strokes in Stokes' 'programmable' cycle engine





The first 'Stokes' engine working prototype – engineering design, development and testing was undertaken by Queensland-based e3k.

New product development engineers e3k have designed, developed and tested a novel internal combustion engine that is the brainchild of Queensland inventor Rick Stokes.

The prototype had been in e3k engineering design and development stages for three years and subsequently underwent extensive dynamometer testing at the Queensland Manufacturing Institute (QMI) laboratory within the Brisbane Technology Park at Eight Mile Plains during 2008 and 2009.

The 'Stokes' engine is a novel 200cc reciprocating internal combustion engine that allows a customised thermodynamic cycle to be used in order to improve fuel efficiency.

Duncan Gilmore, e3k's president, said, "By combining a novel mechanical layout with the latest fuel delivery technology, the engine embodies new ways of thinking about engine design in an increasingly energy-constrained world. The project exemplifies the capabilities of e3k's highly skilled professional engineers in 'turning ideas into reality'."

Richard Billet, e3k Research and Development engineer, who was responsible for testing and optimising the newly constructed engine, said, "The analysis of the performance of such a novel cycle engine has proven challenging, but has given us the opportunity to be part of a very unique and worthwhile project, outside the realms of mainstream engine development."

DIFFERENT STROKES

The motion of the pistons in most internal combustion engines is controlled by the crankshaft. However in the Stokes engine, the ability to control the motion of the pistons during any point in the cycle allows design engineers to customise a cycle to promote specific requirements such as improved efficiency, emissions reduction, high torque, or high power. It is 'programmable'.

Theoretical analysis on one particular customised cycle, initially performed by e3k engineers, showed that this improvement in fuel efficiency could be as much as five percent over a traditional crankshaft controlled cycle.

The Stokes engine concept achieves higher torque at low speeds while minimising heat loss through the walls of the combustion chamber. This efficiency achievement would be regarded as a large percentage for the world's internal combustion engines seeking to maximise every available amount of energy out of a barrel of oil.

The single cylinder, twin opposed-piston design which was completely designed and built in Brisbane, is reminiscent of the Commer 'Knocker' engine developed in the early 20th century. Opposed-piston engines have been used extensively in trains, aircraft, tanks and powerboats.

The Stokes engine prototype was designed from 'the ground up' by e3k, with due consideration being given to the exacting combustion cycle, the method of lubrication, cooling, balance, electronic control, fuel systems, and naturally the ability to be manufactured and operated when connected to a dynamometer.

The prototype, which aimed to be representative of the world's best technology, not only contained the highly innovative Stokes combustion cycle, but also used many off-the-shelf technologies such as the trademarked Orbital Synerject Direct Injection fuel system, now commonly used in marine jet-skis, marine outboards and motor-scooters.

This system allows leaner burning combustion that improves efficiency. Injection and spark timing are electronically controlled via an Autronic SM4 computer that provides easy fine tuning via a laptop. Power output was captured by e3k on a GoPower dynamometer.

Inventor Rick Stokes, with co-developer Nigel Stokes, said, "The engine represents the culmination of decades of work, firstly in conceiving the idea, proving it theoretically, building an early-stage proof of concept prototype, and now actually building a highly customised working engine so that it can burn fuel and produce power."

The R&D work started as a theoretical analysis by e3k of the proposed engine cycle in 1998. The decision to commit to making a working prototype was made some time later in 2004 with the detailed engine design, construction and commissioning occurring over the next five years. Optimisation of a design via a 3D CAD modelling process highlighted challenges and pushed e3k engineers towards innovative solutions.

The engine operated very successfully in January 2008, running immediately, with subsequent time used to optimise the output.

The first prototype was designed as a platform to test the theory behind the programmable engine cycle. Positive results and trends in 2009 have driven a desire to move towards developing the engine for commercial use in applications such as generators where efficiency is key to a successful product.

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