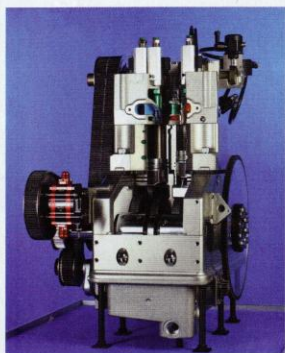


Scuderi Cycle

Intake, compression, combustion, exhaust – it's been a feature of mainstream engine technology for 150 years. Known as the Otto Cycle, it's named after German engineer Nicolaus Otto, who built the first car that burned fuel inside a piston chamber. And that's been the key element – all four stages of the cycle have always taken place inside the same cylinder. But that could be about to change.



A US company has turned tradition on its head, secured more than 200 patents in 60 countries, and claims that progress is being tracked by 14 of the world's top 20 engine makers. Selling it under licence to any one of them would change engine development forever. It's a split-cycle engine, which means the four stages are divided between two separate but paired cylinders. The first is where intake and compression take place, the second is for combustion and exhaust. In short, it's an air compressor on one side and a combustion

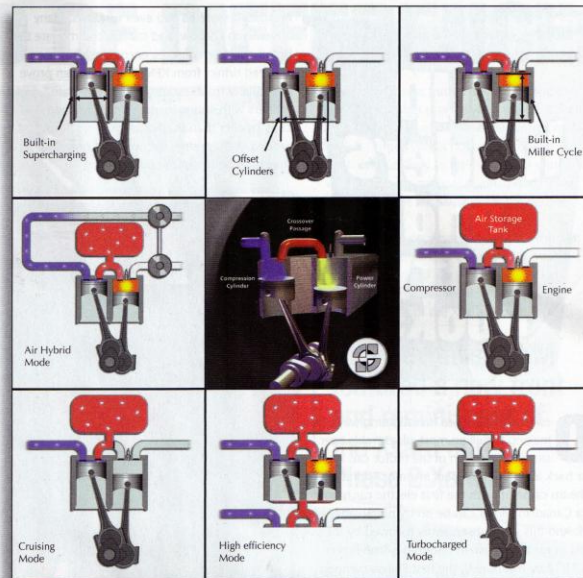
chamber on the other, and they are linked by a crossover passage at the top. It works with both diesel and petrol, naturally aspirated or turbocharged, and as a hybrid. This isn't new technology. The earliest split-cycle engines date back almost a century, but none has matched the efficiency and performance of conventional units. The team behind this latest attempt is known as the Scuderi Group and they believe they've solved the problems. Success would mean the cleanest internal combustion engines ever created, with overall emissions down a staggering 80 per cent compared with traditional items. The firm has bold plans for its innovation. It wants to be the patented technology present in all mainstream powertrains. Think silicon chip maker Intel and its relationship to the global computer industry. The Scuderi Cycle, named after the man who developed the new engine (see below), has two patented technologies at its heart. The first is a unique valve design. On the compression side of the engine, clearance between the piston and cylinder head is reduced to less a millimetre. Outward opening valves enable the piston to move very close to the cylinder head, which pushes almost all the air into the crossover passage. It eliminates the breathing problems historically associated with split-cycle engines. The second, and according to the Scuderi Group, the single most important breakthrough is igniting the mixture as the piston is on its

down stroke, or 'firing after top dead centre'. This is a non-starter in conventional engines, but in a split-cycle system creates a highly efficient thermal reaction. How much more efficient? Emissions and fuel economy depend on the size of the engine and what it's trying to power. However, a simple 1.0-litre prototype has been built and tested extensively. Results suggest a 10 to 15 per cent improvement in performance is possible under full load conditions – but that's just the beginning. Bill Wrinn, director of the Scuderi Group, told Diesel Car: "Early projections have

"...the single most important breakthrough is igniting the mixture as the piston is on its down stroke..."

shown us that drivers of standard vehicles today have the potential to gain up to 50 per cent more mileage when the Scuderi Engine is used with turbocharging and hybrid features." History is littered with claims of new technology that will change the face of motoring forever – so what makes this one different? Wrinn believes credibility comes from the industry players who are very closely following the Scuderi Group's activities. "If there was nothing to this and the science wasn't sound, these engine companies wouldn't have agreed to see us for a second time. With many of them, we've already had several meetings, and some have been to our test facility in Texas to see the engine working." Confidentiality agreements mean Wrinn can't directly name the firms involved, but a recent Wall Street Journal article suggested they included Honda, PSA Peugeot Citroën, Fiat and Daimler. Wrinn doesn't disagree. "Our business model is to licence the rights to the engine, not make them ourselves. That would be a very complex thing – have you ever been to an engine assembly plant? It makes business sense for us to sell the rights and the buyers can do what they like with it."

Part of the reason for this approach is that the Scuderi Cycle doesn't just have automotive applications. Any piston-driven engine, from motorbikes to planes, trains, generators and mowers, could benefit. "That's why it makes sense to licence to engine makers," said Wrinn. "The next stage (what the Group is currently working on) is to create an engine map. It's basically a highly detailed report of test results which shows how the engine runs from 0 to 4,000rpm at every load and speed. As to the future, time will tell. "When it appears in a production car is out of our control. We may have our first licence as early as this year, and then it's typically a three to five year process after that before an engine goes into production. It will definitely be less than 10 years and could be less than five." DC



Carmelo Scuderi (1925 to 2002) was an American inventor specialising in mechanical design, thermodynamics and fluid mechanics. He worked on everything from torpedoes and NASA spacesuits to

fire suppression equipment for aircraft carriers. In 1992, he developed a fridge compressor to prevent the release of chlorofluorocarbons (CFCs) into the atmosphere. On its launch, it took 70 per cent of the market within a year.

It remains the industry standard, and, in 2005, Discovery magazine named it one of the key reasons for the slowed depletion of the ozone layer. Scuderi was always convinced that there was a more efficient system for powering vehicles than the traditional internal combustion engine. In 1994, he started developing a new system, and in 1998 began what would become the Scuderi split-cycle engine. It was finished in 2001 and he began securing patents. He died suddenly the following year, but his legacy is being carried on by his family, which formed the Scuderi Group. To date, and with \$40 million spent, more than 200 patents in 60 countries have been granted.

