Dr. Ioannis Vlaskos
 Director Engines Business Unit
 and Director of the Global Market
 Sector Marine, Ricardo Deutschland

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A New Chapter in Engine Development

The invention of the first internal combustion engine gave rise to a cornucopia of new ideas among the pioneers of the time. Harry Ricardo was one of them. He founded his company in 1915 with the aim of providing access to the findings of scientific research by the young engine industry. For example, his invention of the „turbulent head“ significantly improved combustion in side-valve engines by introducing a quench space in the cylinder head to generate a turbulent flow. This made it possible to produce low-cost engines based on already existing designs that nevertheless offered acceptable performance and fuel consumption. In the economically difficult period after the First World War, this was tremendously important for the advancement of mobility.

By contrast, the development of powerful engines for civil and military aviation had completely different demands. The need for maximum power density and the ability to operate even at high altitudes gave birth to fascinating but also very complex and costly solutions. These developments culminated in the Rolls-Royce Crecy project. This two-stroke engine with sleeve valves, direct petrol injection and a very high power density ultimately fell victim to the rapid progress of the gas turbine jet engine in aviation engineering. The Crecy project was abandoned and the engine never went into service.

Further development of the diesel engine towards smaller units with acceptable noise, soot emissions and smooth running characteristics was one of the more urgent challenges. From 1931 onwards, and initially commissioned by the London General Omnibus Company, Ricardo developed the swirl cham-

ber combustion process, which provided low-soot operation and smoother running for „small“ diesel engines. The system continued to be used in several generations of passenger car diesel engines even into the 1980s.

In the 1960s, electronics began its relentless advance into automotive engineering. Computer-aided calculation processes made it possible to make predictions on the strength and vibration behaviour of components, and later even on the combustion process itself. What is more, the ignition, mixture formation and supercharging of engines were increasingly being controlled by electronic control units, or ECUs.

At the same time, public attention was turning to the problem of emissions, in particular those generated by motorised traffic. Refinements in sensor systems and more advanced ECUs as well as innovations such as three-way catalytic converters, diesel oxidation catalysts, particulate filters, NO_x storage catalysts and SCR processes succeeded in reducing emissions to a fraction of the levels common in the 1960s.

The best engines of today seem to be approaching the limits of what is thermodynamically feasible, especially as some are now being fitted with systems that utilise waste heat. But the development is not yet at an end. Ricardo released a new chapter in the history of the internal combustion engine: New thermodynamic cycles with internal heat recirculation have the potential to extend today's limits even further. Even after a hundred years, innovation and a pioneering spirit remain the lifeblood and the driving force at Ricardo.