

# Rolls-Royce takes major step towards electrifying flight with successful hybrid aero propulsion tests

Rolls-Royce has taken a significant step towards realising our ambition to provide hybrid-electric propulsion systems for the next generation of aviation, with successful ground tests of a hybrid system using our M250 gas turbine – a highly successful engine usually powering helicopters. The tests are part of one of the world's most comprehensive hybrid aerospace turbine engine development and integration programmes and pave the way for experimental flights on aircraft in 2021.

We successfully tested the hybrid version of the M250 gas turbine in a ground demonstration setting in three operating modes: Series Hybrid, Parallel Hybrid and Turbo-Electric. The M250 hybrid is planned to be used as a propulsion plant with power ranging from 500kW to 1MW and has the potential to transform aviation power. The system will be used across a range of transport platforms to enable distributed electric propulsion, including EVTOLs (hybrid electric vertical take-off and landing vehicles), general aviation aircraft and hybrid helicopters.

Dr Mike Mekhiche, Deputy Director, Rolls-Royce Electrical said: “Rolls-Royce has always been a pioneer in aviation and one of the key elements of [our strategy](#) is to champion electrification across all our businesses. The successful testing of the hybrid M250 system is an important step forward in providing a hybrid-electric propulsion system that will enable a new class of quieter and cleaner air transport.”

Rolls-Royce engineers based in the United States, UK and Singapore have developed this engine into a hybrid-electric propulsion system. The M250 gas turbine engine has powered more than 170 varieties of fixed-wing military, civilian aircraft and helicopters since its initial development. Rolls-Royce selected this engine for its maturity, power-density, ease of maintenance, and high reliability. In the past half-century, M250 variants have logged more than 250 million flight hours and nearly 33,000 M250 engines have been delivered to customers.

Complete engine testing took place at our state-of-the-art facility in Indianapolis, US, where each component and sub-system of the hybrid engine was individually tested for electrical performance. These tests included simulating use across take-off, cruise, landing and taxiing and confirmed the system's suitability for a range

of transport platforms including aircraft with a range of up to 1000 miles and weighing up to 2000kg. This would support the Rolls-Royce EVTOL concept which was unveiled during the Farnborough Air Show in the UK last year as well as meeting many other customers' requirements.

Dr Mekhiche added: "Electrification is one of the most exciting developments in aviation since the birth of the jumbo jet. We are determined to use our pedigree in aerospace to be at the forefront of developing innovative propulsion systems to meet the needs of the next chapter in aviation. When this happens, it's going to transform the way aero transport is designed and produced, reducing the time required to travel, revolutionising cargo delivery and changing the way we design our cities and infrastructure."

The Rolls-Royce hybrid electric propulsion system demonstrator integrates a M250 gas turbine engine with a high energy density battery system, electric generators, power converters and an advanced power management and control system. The power management system optimises overall propulsion performance in order for the system to be suitable across a variety of platforms, including EVTOL, while delivering efficiency gains, reduced noise and lower emissions.

Tests were successfully carried across three system configurations:

- **Series Hybrid:** In this configuration, the engine operates as a turbo-generator that charges an on-board battery system, and does not contribute to thrust directly. All power required for thrust and other onboard systems is supplied by the battery.
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- **Parallel Hybrid:** In this configuration, the platform thrust is supplied by a combination of the engine (mechanical thrust) and the electrical system (electrical thrust), while the other power needs of the aircraft are met by the battery.
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- **Turbo-Electric mode:** In this configuration, the battery system is redundant. The engine operates as a pure turbo-generator supplying electric power for thrust and any other power needs on the aircraft.

The next step is to further advance the hybrid propulsion system towards integration on an aircraft and experimental flights in 2021. The M250 hybrid power pack complements the AE 2100 2.5MW system being developed for larger aircraft, including regional aviation, and is being tested with Airbus on the E-Fan X demonstrator platform.

