Rolls-Royce

The Rolls-Royce Trent 7000 engine

Key facts at a glance:

- Exclusive engine for the Airbus A330neo family
- Combines experience from the Trent 700 - the engine of choice for the current A330; architecture from the Trent 1000 TEN - the latest version of the Trent 1000 engine; latest technology from the Trent XWB - the world's most efficient large civil engine
- The 7th member of the Trent family
- Step change in performance from Trent 700 - specific fuel consumption reduced by ten per cent; twice the bypass ratio; significant reduction in noise.
- Trent 7000 engines are assembled & tested in Derby, United Kingdom, and Seletar, Singapore, then shipped to the Airbus facility in Toulouse, France, to be fitted to the A330neo.

Background:

- Optimised for the Airbus A330neo family
- Delivers 68,000 to 72,000 lbs of thrust
- Contributes to the A330neo's 12 per cent fuel burn improvement compared to previous generation aircraft.
- Low fuel burn also means low emissions – the Trent 7000 meets both current and proposed future emissions standards for aero engines, as well as those for noise.
- More than 20,000 parts have been integrated to deliver the Trent 7000.

Example technologies include:

- A compressor that "squeezes" air entering the engine's core to one fiftieth of its original volume – the equivalent of reducing a telephone box of air to a shoebox
- Advanced materials and ceramic coatings on High Pressure turbine blades that operate in temperatures of 1700C, nearly half the temperature of the sun's surface.
- 24/7engine health monitoring that relays key performance information back to a Rolls-Royce operations desk – enabling immediate analysis and maintenance planning to keep aircraft in service

Engine development story for the Trent 7000:

- **July 2014** - Trent 7000 programme launched at Farnborough Air Show
- **November 2015** - First demonstrator engine run
- **June 2017** – Engines despatched to Toulouse

    - Test programme locations included:

Facility	Location	Testing carried out
Rolls-Royce Indoor Test Facilities	Derby, United Kingdom	Endurance, operability, function, performance, bird ingestion, water ingestion
Rolls-Royce Outdoor Test Facility	John C. Stennis Space Center, Mississippi, USA	Cross-wind, noise, cyclic
Arnold Engine Development Centre	Tennessee, USA	Altitude operability, icing

Incredible engineering that brings the Trent 7000 to life … what's inside it:

- Each Trent 7000 is made up of more than 20,000 parts

- The fan case of the Trent 7000, just under 10ft in diameter, is wider than the fuselage of Concorde.

- The fan blades at the front suck in up to 1.3 tonnes (more than a squash court) of air every second at take-off. The blade tips, which move at over 900mph, clear the lining of the casing by a fraction of a millimetre.

- The force on a fan blade at take-off is equivalent to a load of almost 90 tons, the same as nine London buses hanging off each blade.

- Each engine's 20 titanium fan blades are hollow with an internal girder structure to maximise strength. They are created using a process called super-plastic forming and diffusion bonding, where a "sandwich" of titanium is heated in an oven while gas is blown into it to 'inflate' the blade.

- More than 90% of the air sucked through the fan blade actually travels around the engine core and propels the aircraft forward, this is called bypass air and provides 75% of the engine's thrust

- The rest (about a phone box's worth) of the air goes through the engine compressor which squeezes it to one-fiftieth of its volume (about a shoe box). This compressed air then enters the combustion chamber, where the fuel is added and ignited. The hot air then drives the turbines, which in turn drives the compressor and the fan at the front, before adding its own propulsion as it travels on its way out of the back of the engine (at about 1,000 mph).

- Inside the engine each high-pressure turbine blade generates 800hp at take off – the equivalent to that of a Formula 1 racing car – and the blade tips reach 1,200mph (nearly twice the speed of sound).

- These blades operate in an environment where temperatures can exceed 2,000C, above their melting point. To prevent this, each blade has tiny air holes drilled in it where “cooling air” (700C) is blown to cover the blade’s surface

- At full power air leaves the nozzle at the back of the engine travelling at almost 1000mph.