

Description

Etegent, through its e2Sensors division, is developing an array of extreme environment sensors for use in turbine engines. These sensors utilize ultrasonic waveguide technology, enabling the use of almost any material for sensor construction. Etegent has successfully demonstrated waveguide-based temperature, vibration, strain, and pressure sensors. Etegent's temperature sensors have been successfully demonstrated in turbine inlet in a Rolls-Royce 501KB5+ industrial turbine engine.

Benefits

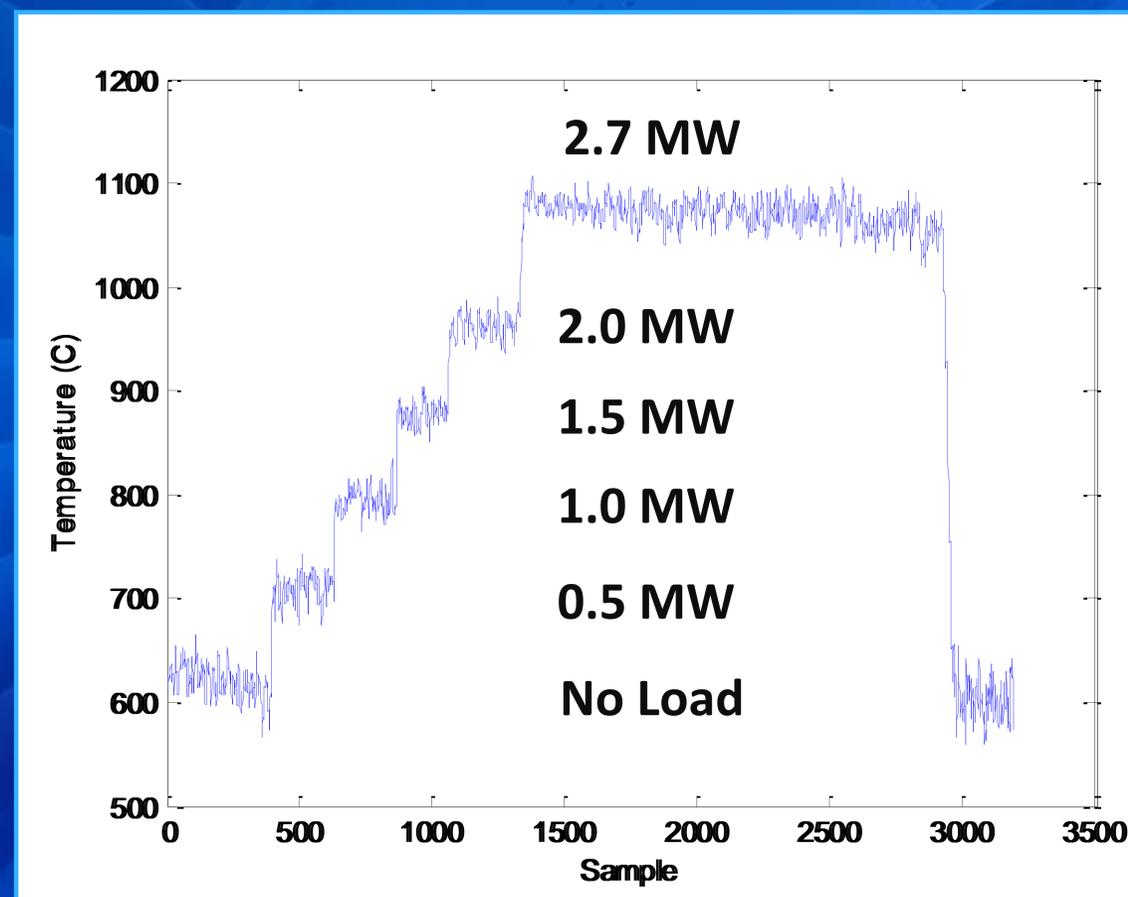
Direct, "on-wing", measurement of turbine inlet temperature enables optimized control strategies which reduce excess margin, improve fuel economy, reduce emissions and offer improved engine performance.



Approach

Waveguide-based sensors utilize ultrasound to interrogate a sensing element, similar to optical fiber-based sensors. Ultrasound propagates long distances along solid wires, enabling transduction materials and electronics to be located far from hot, harsh, or inaccessible environments. Unlike optical fibers, ultrasonic waveguides can be constructed of almost any material, enabling design for robust, reliable operation in any aerospace environment.

The sensing head can be configured to measure temperature, strain, pressure, heat flux, or vibration. Ultrasonic velocity is highly temperature dependent – this enables sensors to be constructed from materials which are already proven for the turbine environment and also provide high sensitivity and accuracy. Etegent's temperature sensors are repeatability to 0.1% over 1000°C in laboratory testing.



Recent Results

Etegent has shown operation of waveguide-based temperature sensors on a Rolls-Royce 501KB5+ industrial gas turbine

- 9/11/2013: Tested Inconel based temperature probe in turbine inlet (2000°F max temperature).
- 11/26/2013: Tested Ceramic temperature sensor in turbine inlet (3000°F max temperature)



Future Work

Work is continuing to further quantify the accuracy and higher temperature operation of the sensor. Key future goals include:

- Calibration to 3000°F and above
- Long term environmental testing
- Construction of form factor suitable for use in production engines

