

## Compact LWIR Borescope Sensor for Thermal Imaging of 2D Surface Temperature in Gas-Turbine Engines

**Authors :** Andy Zhang, Awnik Roy, Trevor B. Chen, Bibik Oleksandar, Subodh Adhikari, Paul S. Hsu

**Abstract :** The durability of a combustor in gas-turbine engines is a strong function of its component temperatures and requires good control of these temperatures. Since the temperature of combustion gases frequently exceeds the melting point of the combustion liner walls, an efficient air-cooling system with optimized flow rates of cooling air is significantly important to elongate the lifetime of liner walls. To determine the effectiveness of the air-cooling system, accurate two-dimensional (2D) surface temperature measurement of combustor liner walls is crucial for advanced engine development. Traditional diagnostic techniques for temperature measurement in this application include the thermocouples, thermal wall paints, pyrometry, and phosphors. They have shown some disadvantages, including being intrusive and affecting local flame/flow dynamics, potential flame quenching, and physical damages to instrumentation due to harsh environments inside the combustor and strong optical interference from strong combustion emission in UV-Mid IR wavelength. To overcome these drawbacks, a compact and small borescope long-wave-infrared (LWIR) sensor is developed to achieve 2D high-spatial resolution, high-fidelity thermal imaging of 2D surface temperature in gas-turbine engines, providing the desired engine component temperature distribution. The compact LWIR borescope sensor makes it feasible to promote the durability of a combustor in gas-turbine engines and, furthermore, to develop more advanced gas-turbine engines.

**Keywords :** borescope, engine, low-wave-infrared, sensor

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