

**Lesley Wright and Carlos Manzanares**  
Mechanical Engineering/Chemistry and Biochemistry

*Temperature Determination Using Infrared Absorption for Gas Turbine Cooling Applications*

With this experimental investigation, a new technique will be developed to obtain temperature distributions of mixed gas streams. The interaction of multiple gases is directly applicable to cooling technology within gas turbine engines. The implementation of the proposed cavity ring down technique will provide invaluable insight into the film cooling jet development along gas turbine airfoils. Gas turbines have been the primary engine for aircraft propulsion for decades, and due to increases in the thermal efficiency of the engines, they are quickly becoming the engine of choice for electrical power generation. With these engines having a direct impact on industrialized societies around the world, it is vital the engines produce maximum power as efficiently as possible. The most direct way to increase the power production of the engine is to increase the engine's operating temperature. With engine temperatures exceeding 3600°F, the turbine components must be actively cooled, so they do not melt under these extreme heat loads.

This experimental investigation will couple the gas turbine cooling expertise of Dr. Lesley Wright with the molecular spectroscopy expertise of Dr. Carlos Manzanares to apply a novel, spectral absorption-based technique to gas turbine cooling flows. A cooled airfoil will be modeled in a low speed wind tunnel, and temperature measurements of the gases, near the cooled wall, will be obtained using infrared absorption. The investigation will develop and validate an experimental method for non-intrusive, near wall temperature measurements of highly turbulent flows. With the implementation of the method, fundamental insight will be gained into the thermal boundary layer development associated with jet - to - mainstream fluid interactions prevalent in gas turbines. With an understanding of these interactions, more efficient cooling technology can be developed which will lead to increased efficiency of the gas turbine engines.