

# **Demonstration of a Mid-Infrared Carbon Monoxide Sensor**

by

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An Abstract of a Thesis Submitted to the Graduate

Faculty of Rensselaer Polytechnic Institute

in Partial Fulfillment of the

Requirements for the degree of

**MASTER OF SCIENCE**

Major Subject: Aeronautical Engineering

The original of the complete thesis is on file  
In the Rensselaer Polytechnic Institute Library

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Troy, New York

April, 2008  
(For Graduation May, 2008)

## ABSTRACT

Initial stages in the development of a carbon monoxide diagnostic are completed. This diagnostic is unique in that it utilizes mid-infrared radiation generated by a quantum cascade laser to perform absorption spectroscopy. Past absorption spectroscopy systems have utilized the near-infrared; the mid-infrared region contains significantly stronger absorption features than the near-infrared, these stronger features can be harnessed to develop a diagnostic which is far more sensitive. The strong sensitivity of mid-infrared spectroscopy and small size of quantum cascade lasers enables the goal of a small, non-intrusive, highly sensitive diagnostic which can be used for process monitoring in various combustion and energy systems.

A brief review of past work with quantum cascade lasers and basic absorption spectroscopy fundamentals are presented. Development of the diagnostic system is described in detail, including the principles behind quantum cascade lasers. Laser functionality is validated and initial qualitative measurements are made; the R(11) carbon monoxide absorbance line is observed and identified. Significant future work is required for accurate qualitative measurements on combustion and energy systems; suggestions for future work are given.