Department of Aerospace Engineering and Engineering Mechanics
College of Engineering

SUMMER RESEARCH OPPORTUNITIES
FOR UNDERGRADUATE WOMEN

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The Department of Aerospace Engineering and Engineering Mechanics is pleased to offer the following research project for the summer of 2007. Interested students are urged to contact the faculty member(s) directing the project that most interests them. By contacting the faculty member, you can discover more about the project, learn what your responsibilities will be and if possible, develop a timetable for the twelve-week research period.

INFRARED ELECTRO-THERMOGRAPHIC DETECTION OF SURFACE CRACKS IN ENGINE COMPONENTS

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Project Description

Thermosonics is a new nondestructive inspection method that uses infrared thermography to detect the excess heat around surface-breaking and near-surface cracks as the component is insonified with diffuse high-intensity ultrasonic radiation. Cracks show up as hot spots because of the friction heat generated between their contacting opposite surfaces. Unfortunately, the rather substantial ultrasonic excitation power required to insonify the interior of the whole component with the necessary sound intensity for crack detection makes the method somewhat impractical on fracture-critical engine components because the driving ultrasonic horn might damage the surface of the component at the point of excitation. It is expected that similar detection sensitivity could be achieved without the danger of surface damage if high-frequency electromagnetic excitation were used in a noncontacting way instead of mechanical excitation. Experiments will be conducted using induction and contact current injection in the 10-100 kHz frequency range to heat the surface layer of the component in a shallow skin depth. The surface temperature will be monitored using a FLIR Systems Thermovision SC6000 MWIR infrared camera to map the temporal variation and spatial distribution of the temperature variations caused by the current concentration in the vicinity of crack tips. The purpose of this preliminary study will be to demonstrate the feasibility of electro-thermograpic crack detection in engine components as a substitute for the presently used liquid-penetrant and replica methods.