

# 2006 Research Infrastructure Program

## University of Southern Maine

**Program focus:** Experimental Investigation, Modeling and Development of MEMS and CNT Based Sensors and Integrated Sensor Arrays

**Lead Principal Investigator:** Dr. Mustafa G. Guvench, Professor of Electrical Engineering, Department of Electrical Engineering

The University of Southern Maine has chosen Micro-Electro-Mechanical Systems (MEMS) gas sensors as the research infrastructure area to develop. This choice is consistent with an ongoing and successful set of work centering on MEMS design and application and is consistent with Maine's S&T strategy. This work will be expanded to involve several faculty members. Undergraduate students can become engaged in MEMS, especially through senior design projects. MEMS and related technologies can be introduced in course work and other educational venues. Longer-range plans include expanding the scope and depth of MEMS work into additional sensing systems.

In this proposal MSGC/NASA Research Infrastructure Grant funding is being sought to enhance ongoing research activities of USM faculty on Micro-Electro-Mechanical-Systems ("MEMS") and to direct them in applications and education toward areas that match interests and missions of NASA and the Maine Space Grant Consortium.

The specific area of R&D proposed is Gas Sensors and Integrated Sensor Arrays based on MEMS- and Carbon-Nano-Tubes (CNT). This is an area that matches well with the widely known work being done at NASA's Jet Propulsion Laboratory (JPL) and Glenn Centers as Electronic Nose development. The ultimate goal of our work will be to develop MEMS sensor arrays integrated with silicon circuits that will detect/monitor/identify gases in a space vehicle or in a lunar habitat environment. Primarily MEMS resonators coated with CNT or polymer films will be employed for gas sensing.

The project will progress in two phases divided into two years: Phase I will focus on the proof of concepts and experimentation with different films for gas absorption on discrete MEMS structures. Phase II will focus on multi-sensor integration and integration of sensors with circuits. Statistical properties of gas sensing will be undertaken in the second year.

In this multi-disciplinary area of research, faculty and students from various disciplines at USM, including chemistry, materials science, statistics, and various aspects of engineering, will participate. A competitive process will be implemented to select student participants.

Table 1 -Team of Faculty Participating in this Effort

Participating Faculty	Department	Area of Expertise
Dr. Mustafa G. Guvench	Electrical Engineering	Microelectronics, MEMS
Dr. James W. Smith	Electrical Engineering	Materials/SEM (electron microscopy)
Dr. James Masi	Electrical Engineering	Materials Science
Dr. Henry J. Tracy	Chemistry	Chemistry and Polymer Science
Dr. Glenn Wilson	Technology	Research Computing Group
Dr. Carlos L. Luck	Electrical Engineering	Robotics
Dr. Mariusz J. Jankowski	Electrical Engineering	Signal Processing
Dr. Abou El-Makarim Aboueissa	Mathematics	Statistics