



Aerospace, Chemical and Material Sciences

05 MAR 2012

Dr. Joan Fuller
AFOSR/RSA

Air Force Research Laboratory

Integrity ★ Service ★ Excellence



Aerospace, Chemistry and Material Sciences



The Directorate leads discovery and advancement of fundamental and integrated science that enables future air, space and cyberspace power.



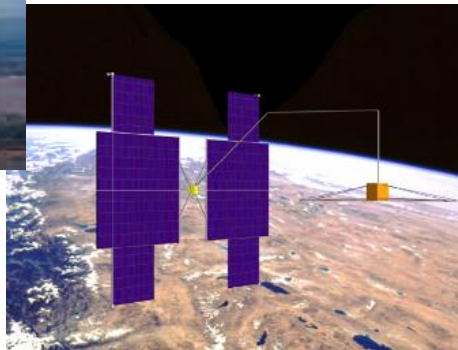
Fluid Mechanics



**Solid Mechanics
& Structures**



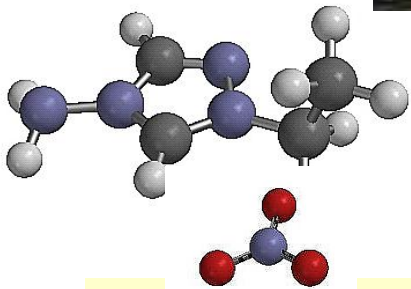
Propulsion



Materials



Chemistry



Transforming the Future of Aerospace Sciences

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RSA Investment Portfolio



Aerospace, Chemical & Material Sciences (RSA)

Aero-Structure Interactions and Control

- Flow Interactions and Control
- Aerothermodynamics and Turbulence
- Aerospace Materials for Extreme Environments
- Test and Evaluation

Complex Materials and Structures

- Organic Materials Chemistry
- Low Density Materials
- Mechanics of Multifunctional Materials
- Multi-scale Mechanics and prognosis

Energy, Power, and Propulsion

- Molecular Dynamics and Theoretical Chemistry
- Energy Conversion and Combustion Sciences
- Space Propulsion and Power
- Thermal Sciences

Programs: 12 Program Manager's Portfolios
Work Unit: >600 Individual Grants, Contracts





AFOSR Material Science Research Thrust Areas

CIMAV Site Visit

23 July 2012

James Fillerup, PE, Director

**Southern Office of Aerospace
Research and Development**

Air Force Office of Scientific Research

Air Force Research Laboratory

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AFOSR Research Thrust Areas (Ref: AFOSR BAA 2012)



Mechanics of Multifunctional Materials & Microsystems

Concepts of particular interest are:

- “autonomic” structures which sense, diagnose and respond for adjustment with minimum external intervention,
- “adaptive” structures allowing reconfiguration or readjustment of functionality, shape and mechanical properties on demand, and
- structural integration of energy harvesting/storage capabilities for “self-sustaining” system.

— Dr “Les” Lee, AFOSR/RSA



AFOSR Research Thrust Areas (Ref: AFOSR BAA 2012)



Multi-Scale Structural Mechanics and Prognosis

- New and revolutionary flight structures,
 - Multi-scale modeling and prognosis and
 - Structural dynamics under non-stationary conditions and extreme environments.
- Dr David Stargel, AFOSR

Basic research that will generate understanding, models, analytical tools, numerical codes, and predictive methodologies validated by carefully conducted experiments.



AFOSR Research Thrust Areas **(Ref: AFOSR BAA 2012)**



Thermal Sciences

- **Increase the understanding required to predict heat transfer across a broad range of temporal and spatial scales.**
 - **phonon transport,**
 - **contribution of phonon dispersion modes to thermal transport,**
 - **understanding of extreme thermal conductivity,**
 - **thermal conductivity in hybrid materials, and thermal rectification and thermal diodes.**
- **Dr Joan Fuller, AFOSR/RSA**



AFOSR Research Thrust Areas **(Ref: AFOSR BAA 2012)**



Aerospace Materials for Extreme Environments

- **Discovery and characterization of high temperature materials (nominally temperatures above 1000°C)**
 - **ceramics, metals, hybrid systems including composites.**
- **Includes the development and experimental verification of theoretical and/or computational tools**
- **Creation of nontraditional approaches on synthesis of novel materials and nanostructures, for example, by using electric fields, lasers, microwave, etc.**
 - **Dr. Ali Sayir, AFOSR/RSA**



AFOSR Research Thrust Areas **(Ref: AFOSR BAA 2012)**



- **Low Density Materials**
- **Materials design and processing to enable radical reductions in system weight with concurrent enhancements in performance and function.**
 - **multi-material, multi-scale, multi-functional material systems**
 - **stimuli-responsive materials that can be used to couple structure and function**
 - **Possible material classes are polymeric, ceramic, and metallic, possibly combining synthetic and biological species**



AFOSR Spring Review 2012



- AFOSR PM research portfolios were presented at the AFOSR “Spring Review”.
- Video streams and presentations can be down loaded at:
 - <http://onlinemediaevent.com/afosrspringreview/>
- The Aerospace, Chemical and Material Sciences PM presented on days 4 and 5.