AFOSR

AIR FORCE OFFICE OF SCIENTIFIC RESEARCH

RESEARCH FOCUS AREAS

We discover, shape and champion basic research that profoundly impacts the future of the Air Force.

TODAY'S BREAKTHROUGH SCIENCE FOR TOMORROW'S AIR FORCE

AFRL

AFOSR

RESEARCH FOCUS AREAS

As an integral component of the Air Force Research Laboratory (AFRL), the Air Force Office of Scientific Research has the responsibility to discover, shape and champion basic research that profoundly impacts the future Air Force. AFOSR's technical experts identify and fund long-range technology options at Air Force, university and industry research laboratories. This support ensures the timely transition of research results that lead to revolutionary scientific breakthroughs, enabling the Air Force and U.S. industry to produce world-class, militarily significant and commercially valuable products.

AFOSR supports transformational research in ten focus areas. Such research is inherently risky, sometimes outside of the mainstream, and often requires an extended period of support. AFOSR has sponsored numerous scientific breakthroughs in the past and solicits new research concepts that will generate tomorrow's breakthroughs.

DISCOVER

SHAPE

CHAMPION

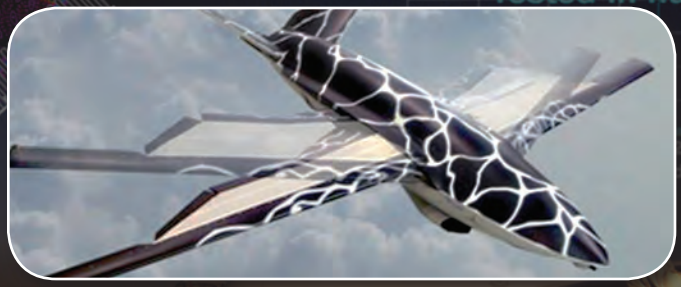
WWW.AFOSR.AF.MIL

Aerospace, Chemical & Material Sciences

Leads the discovery and development of fundamental and integrated science that advances future air and space power

Aero-Structure Interactions and Control Research

This area focuses on the characterization, modeling and exploitation of interactions between the unsteady aerodynamic flow field and the dynamic air vehicle structure to enable enhanced performance in next generation Air Force systems. Of particular interest to this area is the synergy gained from an interdisciplinary look at multiple technologies and the integration of core disciplines of fluid mechanics, structures and materials.



Energy, Power and Propulsion Research

This area focuses on underlying processes associated with the production, storage and utilization of energy specifically for Air Force systems. Examples include developing novel energetic materials as well as understanding and optimizing combustion processes. This cross-cutting, multi-disciplinary focus area seeks to harvest technological innovations and develop potentially revolutionary technologies by integrating core disciplines of combustion, plasma dynamics, chemistry, hybrid simulation, structures and materials.

Complex Materials and Structures Research

This topic focuses on future materials and structures composed of different classes of materials and may be able to change functionality or performance characteristics to enhance the mission versatility of future air and space systems, with a key goal of increasing functionality while decreasing weight and volume. The concentration is on complex materials, microsystems and structures that incorporate hierarchical design and functionality from the nano-scale through the meso-scale, ultimately leading to controlled, well-understood material or structural behavior capable of dynamic functionality and/or performance characteristics to enhance mission versatility.

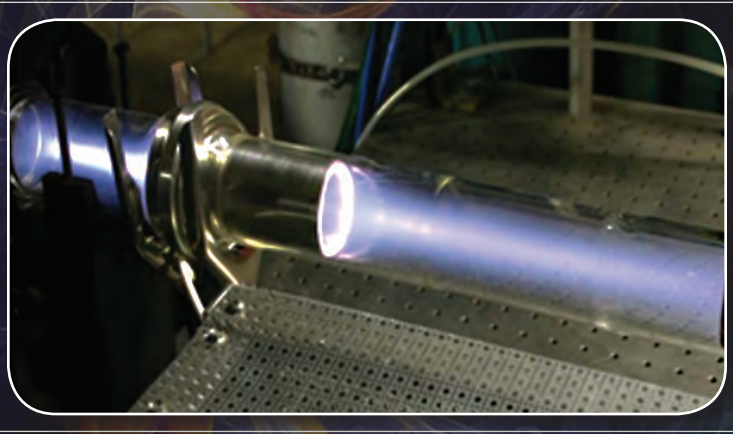
Vibrational Rotational Electro

Physics & Electronics

Generates revolutionary knowledge and research in theoretical and experimental physics needed to advance operational capabilities of the Air Force

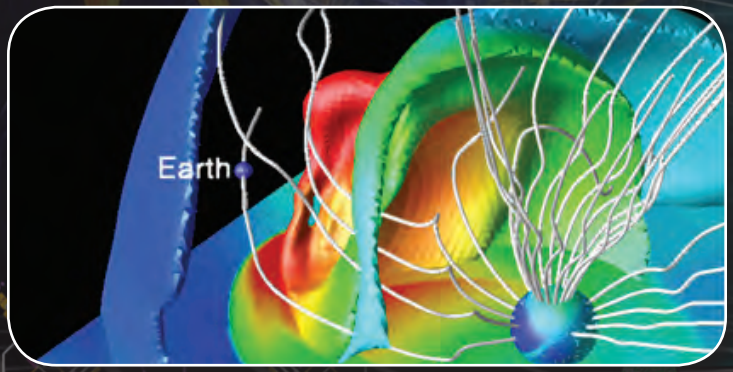
Complex Electronics and Fundamental Quantum Processes Research

This area includes exploration and understanding of a wide range of complex engineered materials and devices, including non-linear optical materials, opto-electronics, meta-materials, cathodes, di-electric and magnetic materials, high energy lasers, semiconductor lasers, new classes of high-temperature superconductors, quantum dots, quantum wells and graphene. It also includes generating and controlling quantum states, such as superposition and entanglement, in photons and ultra-cold atoms and molecules.



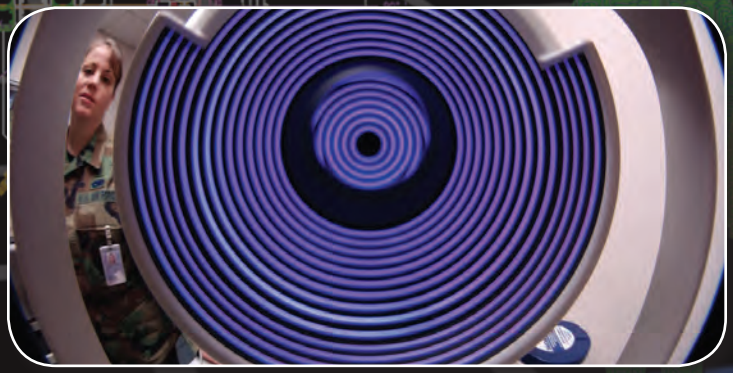
Plasma Physics and High Energy Density Nonequilibrium Processes Research

This area includes a wide range of activities characterized by processes sufficiently energetic to require the understanding and managing of plasma phenomenology and the non-linear response of materials to high-electric and magnetic fields. This includes such endeavors as space weather, plasma control of boundary layers in turbulent flow, plasma discharges, RF propagation, RF-plasma interaction and high-power, beam-driven microwave devices.



Optics, Electromagnetics, Communication and Signal Processing Research

This area considers all aspects of producing and receiving complex electromagnetic and electro-optical signals, as well as their propagation through complex media, including adaptive optics and optical imaging. It also covers aspects of the phenomenology of lasers and non-linear optics. It not only considers the development of physical devices to enable such activities, but also includes sophisticated mathematics and algorithm development for extracting information from complex and/or sparse signals.



Mathematics, Information & Life Sciences

Provides the Air Force with innovative options to increase performance and operational flexibility

Information and Complex Networks Research

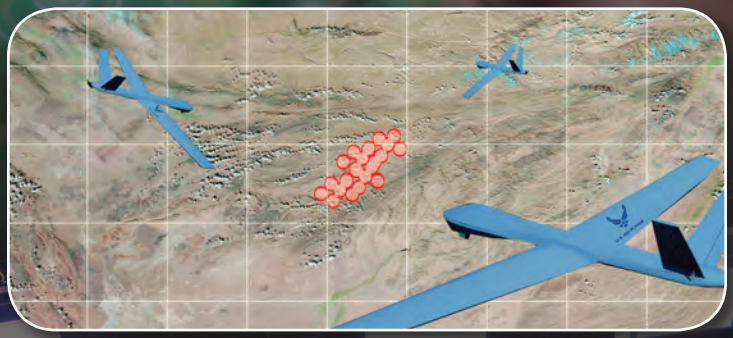
This area focuses on research required to enable reliable and secure exchange of information and predictable operation of networks and systems. Though it includes traditional aspects of information assurance and research into reliable systems, the emphasis is on the mathematics that underlie fundamental new secure-by-design architectures of networked communications and decision-making platforms. Sub-areas that support this scientific focus include: system and network performance prediction, design and analysis; information operations and security; and modeling of human-machine systems.

Decision-Making Research

This thrust focuses on the discovery of mathematical laws, foundational scientific principles and new robust algorithms. They all underlie intelligent, mixed human-machine decision-making to achieve accurate real-time projection of expertise and knowledge into and out of the battlespace. It includes both efforts to advance the critical knowledge base in information sciences and information fusion and to model individual and group cognitive processing and decision-making.

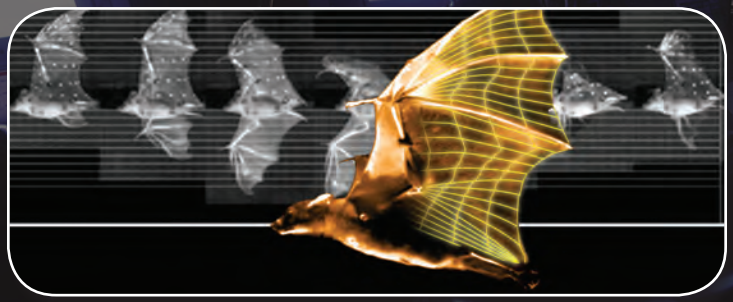
Dynamical Systems, Optimization and Control Research

This area emphasizes mathematical research for discovering new scientific concepts supported by rigorous analysis for advancing the science of autonomy and promoting the understanding necessary to analyze and design complex multi-scale systems as well as provide guaranteed levels of performance. It includes novel adaptive control strategies for coordinating heterogeneous autonomous or semi-autonomous aerospace vehicles in uncertain, information rich, dynamically changing, adversarial and networked environments.



Natural Materials and Systems Research

This area focuses on multi-disciplinary approaches for studying, using, mimicking or altering the novel ways natural systems accomplish their required tasks. Nature has used evolution to build exquisite materials and sensors that often outperform man-made versions. This scientific thrust discovers how to mimic existing natural sensory systems and adds existing capabilities to these organisms for more precise control over their material production.



Broad Agency Announcement (BAA)

Research interests of the Air Force Office of Scientific Research

Doing Business with AFOSR

To facilitate revolutionary scientific breakthroughs, AFOSR solicits research proposals through a Broad Agency Announcement (BAA) that outlines the Air Force Defense Research Sciences program. The BAA provides more detail about the nearly 40 programs that support AFOSR's 10 research focus areas. AFOSR invites proposals in all these areas.

AFOSR is also always open to considering unique research ideas and concepts. Exciting ideas that do not correspond to one of the more specific topic descriptions found in the BAA can be submitted through the Other Innovative Research Concepts program.

All proposals are evaluated on scientific and technical merits of the proposed research and the potential contributions to the mission of the Air Force.

Interested parties can learn more about these areas and the application process by referencing the general BAA. Visit www.afosr.af.mil for AFOSR proposal solicitations and www.grants.gov to apply.

AFOSR FOCUS AREAS:

AEROSPACE, CHEMICAL AND MATERIAL SCIENCES

- *Aero-Structure Interactions and Control*
- *Energy, Power and Propulsion*
- *Complex Materials and Structures*

MATHEMATICS, INFORMATION AND LIFE SCIENCES

- *Information and Complex Networks*
- *Decision-Making*
- *Dynamical Systems, Optimization and Control*
- *Natural Materials and Systems*

PHYSICS AND ELECTRONICS

- *Complex Electronics and Fundamental Quantum Processes*
- *Plasma Physics and High Energy Density Nonequilibrium Processes*
- *Optics, Electromagnetics, Communication and Signal Processing*

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Today's Breakthrough Science for Tomorrow's Air Force