



AFRL

THE AIR FORCE RESEARCH LABORATORY
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AFOSR Overview

Dr. Terence Lyons

Program Manager

AFOSR/NL

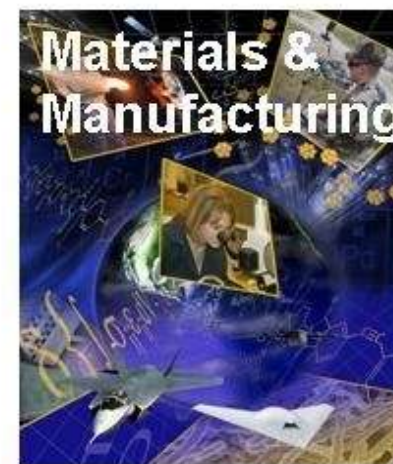
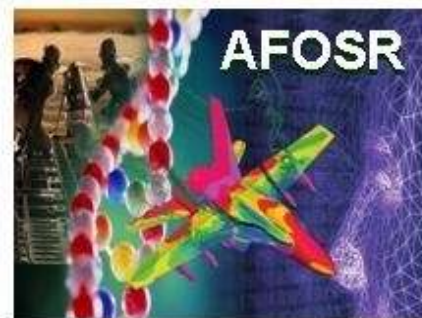
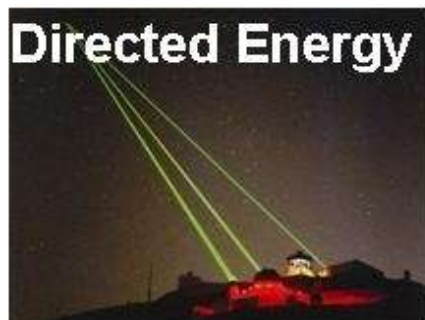
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Air Force Research Laboratory



The Air Force's Corporate Research and Development



AFOSR Vision & Mission



Vision: The U.S. Air Force dominates air, space, and cyber through revolutionary basic research.

Mission: We discover, shape, and champion basic science that profoundly impacts the future Air Force.

- ID Breakthrough Research Opportunities – Here & Abroad
- Foster Revolutionary Basic Research for Air Force Needs
- Transition Technologies to DoD and Industry

TODAY'S BREAKTHROUGH SCIENCE FOR TOMORROW'S AIR FORCE



AFOSR Roles

AF Basic Research Manager



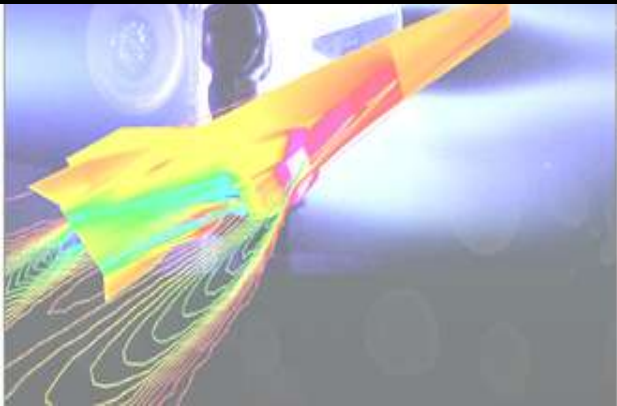
- **Identify Breakthrough Research Opportunities – Here & Abroad**
 - Regular interactions with leading scientists and engineers
 - Liaison offices in Europe, Asia, Latin America
 - 179 short-term foreign visitors; 28 personnel exchanges
 - 93 summer faculty; 55 postdocs/senior scientists at AFRL
- **Foster Revolutionary Basic Research for Air Force Needs**
 - 1162 extramural research grants at 190 U.S. universities
 - 246 intramural research projects at AFRL, USAFA, AFIT
 - 179 STTR small business - university contracts
 - 565 fellowships; 1574 grad students, 530 post-docs on grants
- **Transition Technologies to DOD and Industry**
 - 58 workshops conducted; 210 conferences co-sponsored
 - 686 funded transitions in FY08 data call (64% response rate)



Basic Research Focus Areas

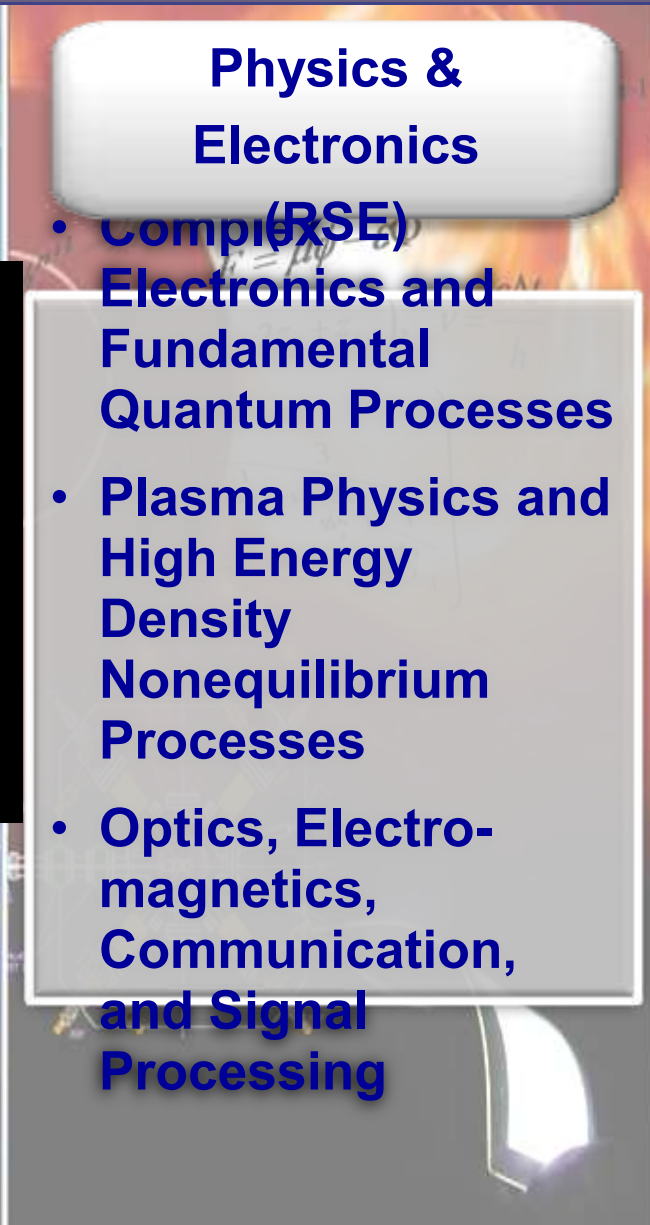
Aerospace, Chemical & Materials Sciences (RSA)

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



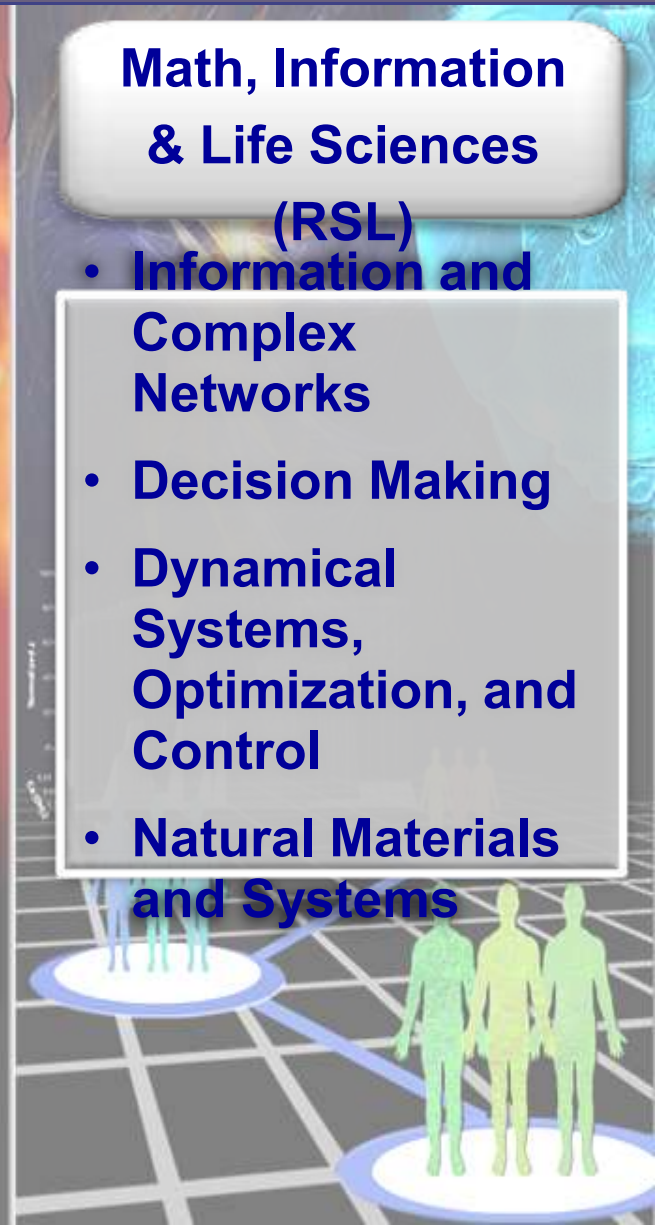
Physics & Electronics (RSE)

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



Math, Information & Life Sciences (RSL)

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





AFOSR Supports University Individual Investigators



- **Goals**
 - Provide revolutionary scientific breakthroughs to maintain military air, space, and information superiority
 - Build collaborations between AFRL and universities
- **General Process**
 - Researchers submit white papers to AFOSR program managers
 - Promising white papers lead to request for full proposals
 - Proposals merit reviewed for *excellence* and *relevance*
 - Individual grants awarded for up to 5-years in duration
- **Broad Agency Announcement (BAA) open at all times to innovative ideas <http://www.afosr.af.mil>**



AFOSR Supports Multidisciplinary University Research (MURI)



- **Achieve significant scientific advances**
 - **Capture attention of top researchers**
 - **Build on results of individual-researcher grants**
 - **Encourage multidisciplinary collaboration**
- **Up to \$1.5M/yr for five years**
- **Typically 8 research topics per Service**
 - **Occasional joint topics**
 - **One or two awards per topic**
- **Currently there are 61 AFOSR MURI Projects (FY05-09)**
 - **Funded 15 projects in FY09**



Small Business (University-Industry) Collaborations (STTR)



- **Small Business Technology Transfer (STTR) program provides up to \$850,000 for early-stage R&D directly to small companies working cooperatively with research institutions**
(<http://www.acq.osd.mil/sadbu/sbir/>)
 - Company must be U.S. for-profit small business; 500 or less employees
 - Research institution must be a U.S. college or university, FFRDC, or non-profit research institution
 - Principal investigator must be employed at small business or research institution
- **Air Force plans to support 30 topics for FY10**
 - July 20, 2010: Solicitation issued for public release
 - August 17, 2010: DoD began accepting proposals
 - September 15, 2010: Deadline for receipt of proposals
 - February 3, 2011: Contracts awarded



AFOSR Supports Tomorrow's S&Es



- **National Defense Science and Engineering Graduate Fellowship (NDSEG)**
 - ✓ Full tuition assistance + \$31K/per year stipend
 - ✓ Fellows do not incur any service obligation
 - ✓ Supports over 550 PhD-track graduate students
 - ✓ More info: <http://www.asee.org/ndseg>
- **Awards to Stimulate and Support Undergraduate Research Experience (ASSURE)**
 - ✓ Provide undergraduates with research opportunities in S&E fields of DoD interest
 - ✓ Supports over 500 undergraduate students during summer months
 - ✓ More info: <http://www.afosr.af.mil>
- **Presidential Early Career Award for Scientists & Engineers (PECASE)**
 - ✓ Recognize outstanding young S&Es in AF interest areas
 - ✓ 5-year awards \$200K/year (up from \$100K)



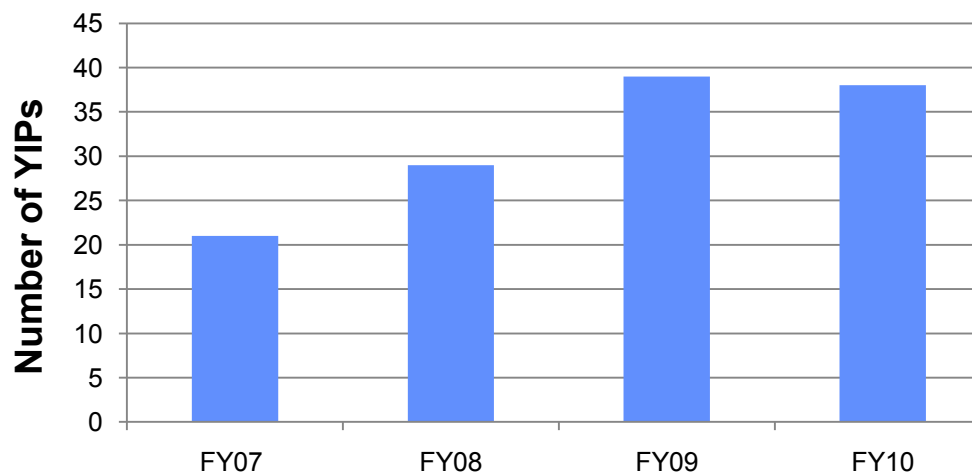


AFOSR Supports Tomorrow's S&Es

(Cont.)



- **Young Investigator Program (YIP)**
 - ✓ Develop long-term relationships with leading junior PIs
 - ✓ 127 YIP awards since FY07; 38 awards in FY10
 - ✓ Awards up to 5 years at \$120K/yr beginning in FY09
 - ✓ Must have received PhD in the last five years





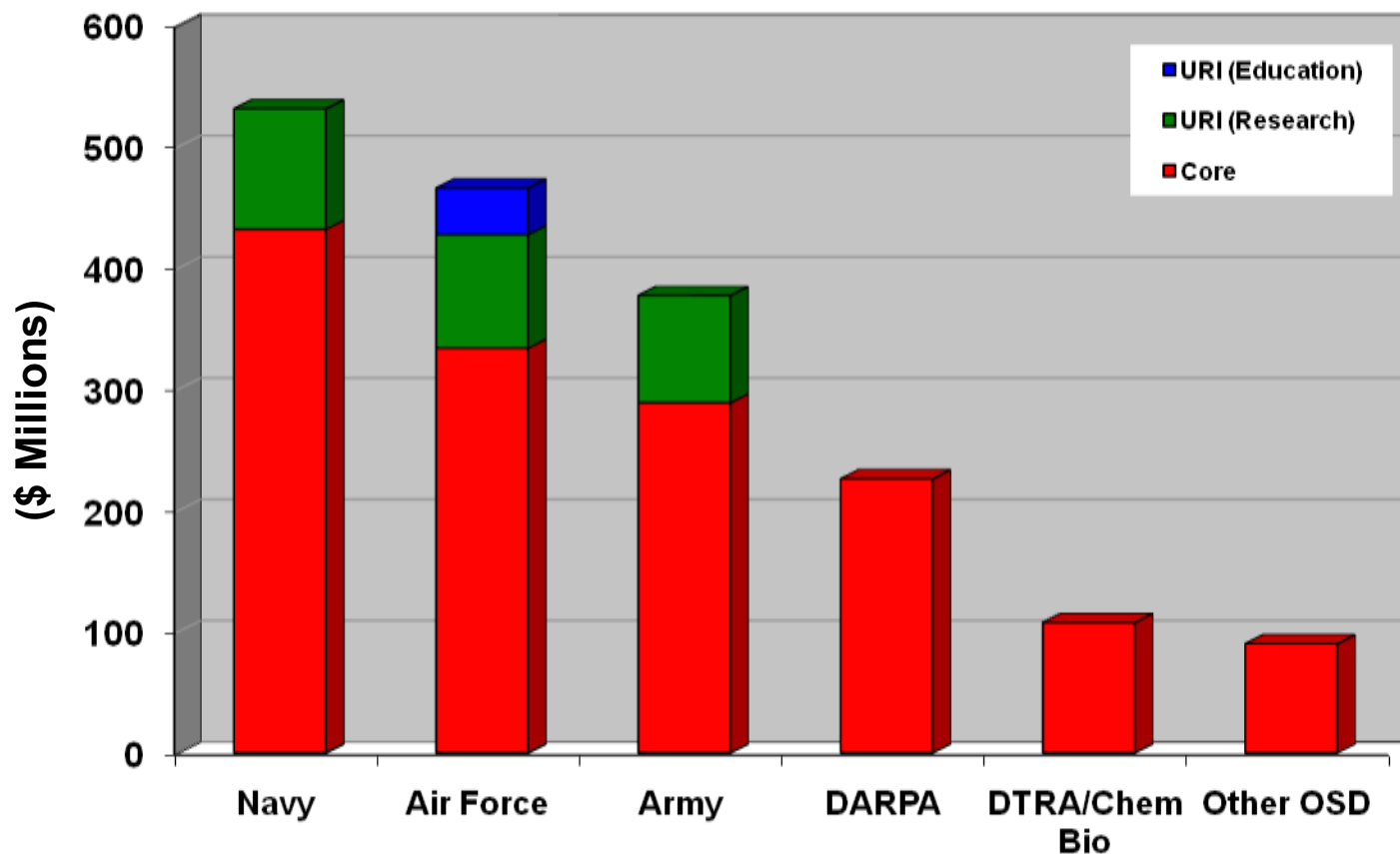
National Security Science and Engineering Faculty Fellowships



- **DDR&E program, managed by AFOSR**
- **Objectives**
 - Excellent unclassified basic research on topics of interest to DoD
 - Long-term relationships with outstanding faculty and students
 - Familiarity with DoD missions, technologies, and challenges
 - Cadre of technical experts for DoD advisory groups
- **Award Information (Eleven awards in FY10)**
 - Single-investigator awards up to \$850K/yr for up to 5 years
 - Open to faculty at US doctoral degree-granting institutions
 - US citizens and permanent residents are eligible to apply
- **Application process** (more info at <http://nsseff.ida.org/>)
 - Letter of intent to nominate from home institution
 - Formal nomination letter and white paper
 - Full proposal and oral presentation (by invitation only)



DoD Basic Research Enterprise



DoD Total FY10 Basic Research Budget = \$1.8B



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AFOSR

Collective Behavior and Socio-Cultural Modeling

22 March 2009

Dr. Terence Lyons

Program Manager

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What are the hard technical issues in your portfolio? #1



- **Basic social science often not understood**
 - **Collective models less developed than individual models**
 - **Non-rational behavior (e.g., emotions, beliefs, & values) less understood than rationale behavior**
- **Meso-level less studied and data harder to find**
- **No standard definitions/taxonomy/ontology for culture; no unified model or theory - embedded in specific social systems, multiple disciplines, but no common language or notation**
- **DATA ISSUES: Reliance on observational data from multiple sources/biases: Diverse, incomplete, multi-lingual, inconsistent coding, non-current, estimated, codes dropped/added, mixed data including parametric and non-parametric data, survey data limited to stated vs. revealed preferences (semantic reports).**
 - **Automatically extracted data particularly subject to bias and not easily verifiable - sampling bias, echo, etc.**



What are the hard technical issues in your portfolio? #2



- **Data often sparse for areas of real interest - limited empirical culture data: field work necessary when data may be manipulated – allows higher standards of verification**
- **How universal is the dataset: e.g., do gangs share common characteristics with terrorist networks, do the “troubles” in Northern Ireland share commonalities with Middle East terrorism, etc.**
- **How robust are the models to errors in the data?**
- **Relevant experimental data very sparse, simplified scenarios & limited choice of laboratory subjects**
 - **Are on-line games generalizable to real world behavior?**
- **Reliance on descriptive studies subject to sampling error, random misclassification, selection/measurement bias, & confounding**
- **Multiple possible independent & dependent variables. Is there continuity of the variables?**



What are the hard technical issues in your portfolio? #3



- **Causal structure is unknown: Complex, multi-factorial causation is the rule, bi-directional causation possible**
- **What is the optimum scale at which to model collective behavior?**
- **Multiple possible modeling approaches**
 - **Dynamic/temporal dimension (order of actions) & spatial dimensions (geography) poorly captured by existing models. “When” is difficult to predict.**
- **Multi-level problem:
national>regional>local>individual>brain>amygdala>etc**
- **Computational intractability – Cumulative uncertainty - Multiple possible actions and outcomes (dependent variables) - n possible actions = 2^n possible worlds - doesn't include spatial or temporal dimension)**
- **Model assessment (“ V&V), model generalizability**



Portfolio Publicity



1. DoD Funds New Views on Conflict With its First Minerva Grants (Science, Vol. 317, p-1039-40, 24 August 2007)
2. Sacred values - implications for negotiation, Atran (Science, Vol 317, p-1039-40, 24 August 2007)
3. “What Can Virtual Worlds and Games Do for National Security?”, Subrahmanian (Science, VOL 326, 27 NOV 2009:1201-2102).



The Computer as a Roadmap to Unknowable Territory(The Washington Post, 16 February 2009)

The Washington Post

- Atran, 25 Jan 2009: “Words to End War”
- Atran, 13 Dec 2009: “To Beat Al Qaeda Look to the East”

The New York Times



Building a Community of Practice



- Fragmented research community - social Science Stovepipes: “inventing their own toothbrushes (theories)”
- Barriers at Universities to Multi-disciplinary Research:
 - Dearth of graduate students and training programs
 - Many non-academic proposals
 - Few young investigators
- Creating a community of practice:
 - Interdisciplinary research
 - International participation
 - “3rd International Workshop on Social Computing, Behavioral Modeling, and Prediction”. 29-31 Mar 10: # 354 registered
- Insufficient AFRL intellectual capital in social science (except Psychology)

