AFOSR Overview

Dr. Terence Lyons

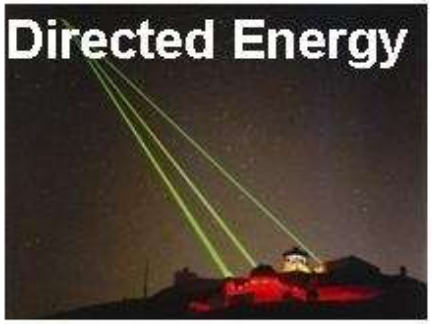
Program Manager

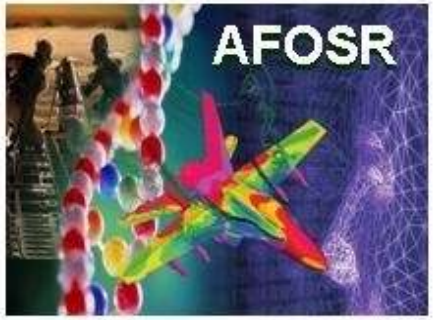
AFOSR/NL

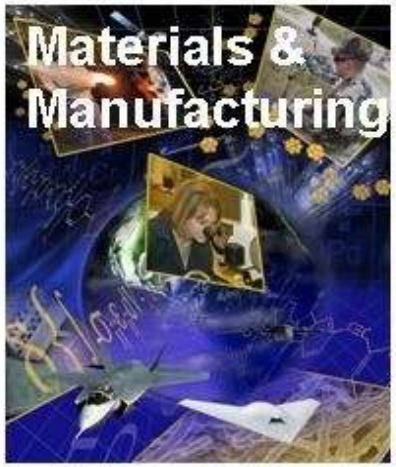
Air Force Office of Scientific Rese

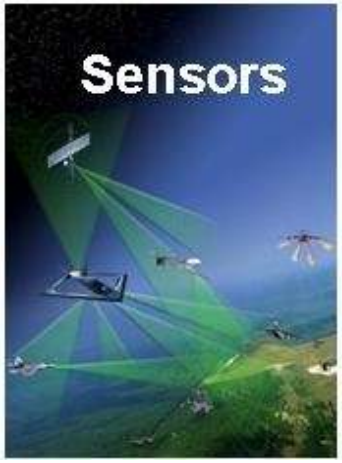
Air Force Office of Scientific Research

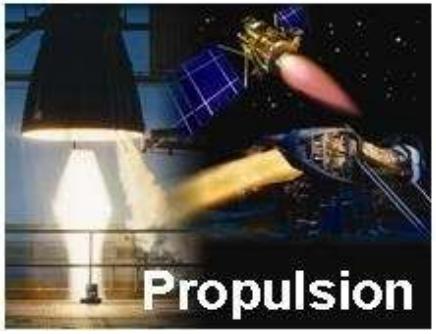
Air Force Research Laboratory

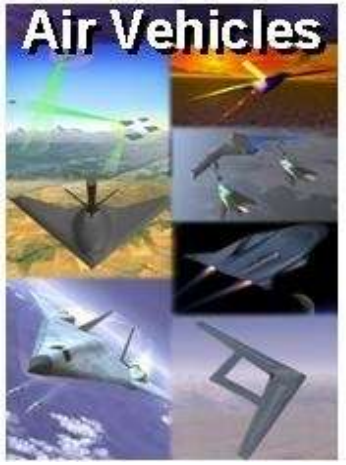












The Air Force's Corporate Research and Development

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

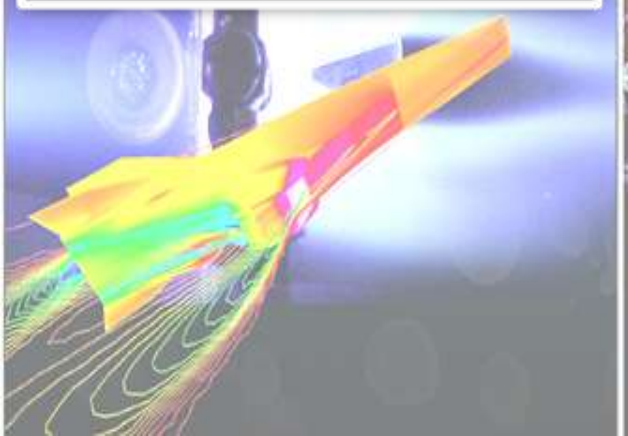
AFOSR Roles
AF Basic Research Manager

- **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, Electro-magnetics, 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

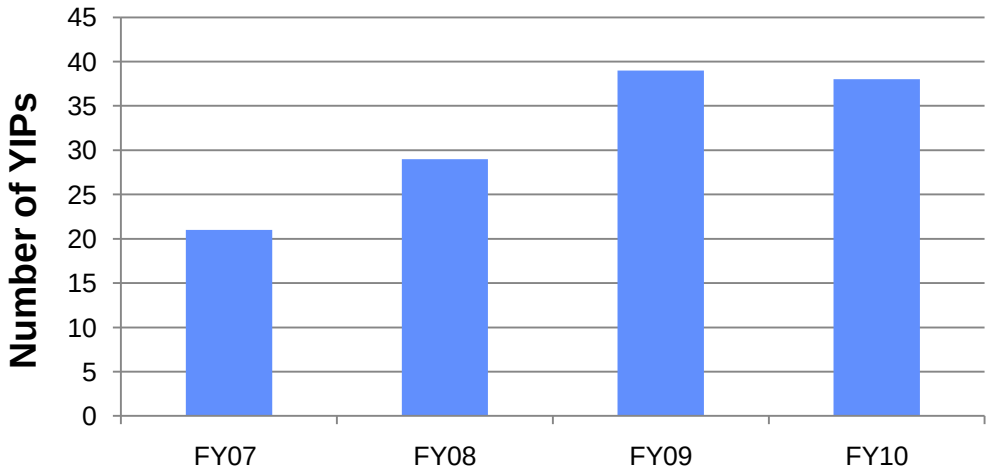
AFOSR Supports Tomorrow's S&Es

- **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

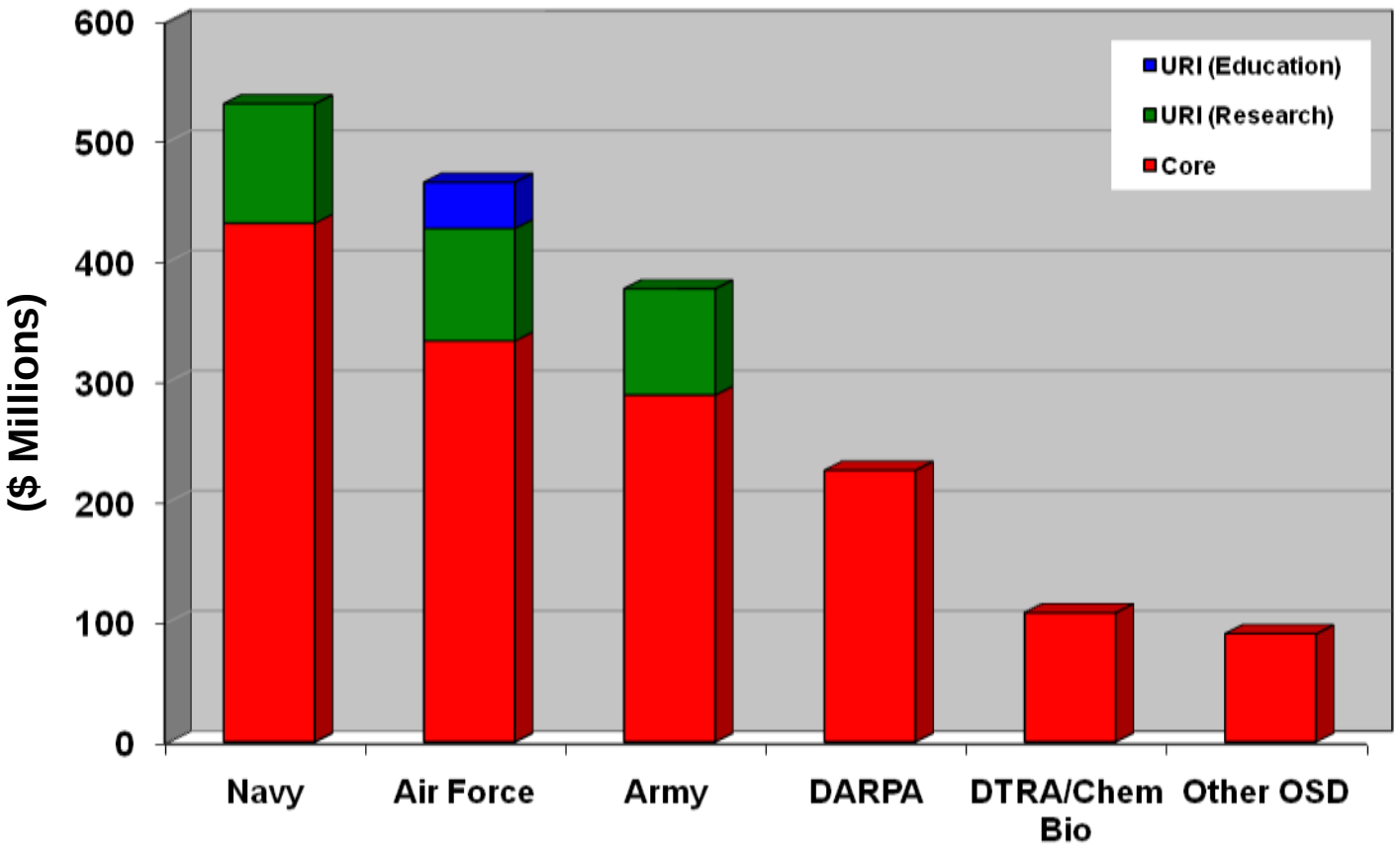


National Security Science and Engineering Faculty Fellowships

NSSEFF
NATIONAL SECURITY SCIENCE & ENGINEERING FACULTY FELLOWS
PART OF THE NATIONAL DEFENSE EDUCATION PROGRAM

- **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

AFRL

THE AIR FORCE RESEARCH LABORATORY

LEAD | DISCOVER | DEVELOP | DELIVER

AFOSR

Collective Behavior and Socio-Cultural Modeling

22 March 2009

Dr. Terence Lyons

Program Manager

AFOSR/NL

Air Force Office of Scientific Research

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 DAILY STAR
LEBANON

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

The Washington Post

Science
AAAS

- 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)**