



Funding Opportunities at the Army Research Office (ARO)

Devendra P. Garg, Ph.D.

Professor & ASME Life Fellow, Duke University

Mechanical Sciences Division

Engineering Sciences Directorate

U.S. Army Research Office

Tel. (919) 549-4324

Devendra.garg@us.army.mil



Objective Force for Full Spectrum of Missions

"If we can't get to the fight faster, we're not relevant"

Environmental Complexity

High ↑

- Urban

↓

- Open, rolling terrain

Low



Increased strategic responsiveness

- ✓ **BCT in 96 hrs; Div in 120 hrs; 5 Div in 30 days**
- ✓ **Fight immediately upon arrival**
- ✓ **Simultaneous air and sea lift**

Stability and Support Operations

Small Scale Contingencies

Major Theater War



Spectrum of Conflict



A Revolution in Capabilities ... Smaller, Lighter & Faster



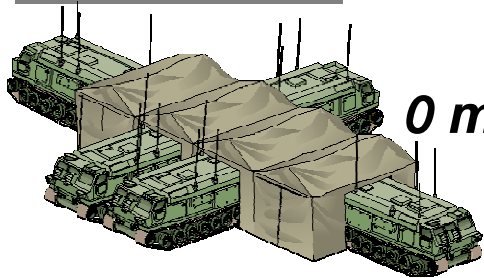
Today



~100 lb.
load

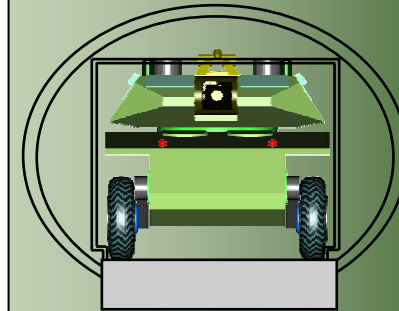


70+
tons



0 mph

Fit the C-130
"Crucible"



> 40 mph

Objective Force

< 30 lb.
effective
load



< 20
tons



Innovation -- Accelerating the Pace of Army Transformation



Potential Technology Areas for Enabling the Objective Force



- Hybrid power systems
- Logistics efficiencies (ultra reliability, fuel efficiency, weight reduction)
- Human engineering and cognitive engineering
- Signature control (including counters)
- Protection schemes for land systems (including active protection)
- Advanced materials and applications
- Affordable precision and alternative lethality means
- Alternative propellants
- Non-lethal capabilities
- Vaccines and drugs for infectious disease and CB protection
- Human physiological knowledge bases, linked to physiological and performance modeling



*Objective Force Warrior - - -
Technology Today for Tomorrow*



Army Basic Research

FY01-05 \$690M*

Exploring the Imaginable

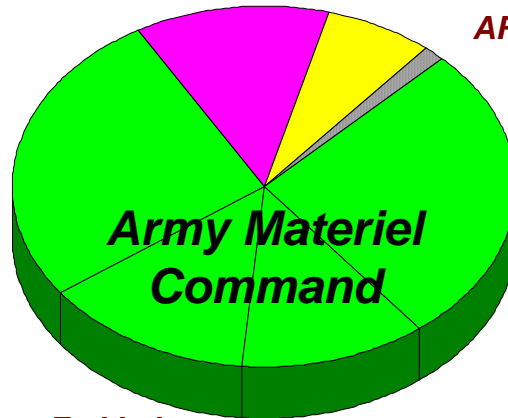
In-house Research at ARL & RDECs

Primarily Intramural 42%

Medical Research & Materiel Command

Corps of Engineers

ARI



Fed Labs

Centers of Excellence

New Knowledge & Understanding for Army-unique Problems

University Single Investigator Program

Primarily Extramural 58%

** plus ~\$300M focused on FCS*

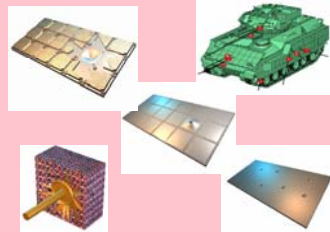
Strategic Research Objectives

- Sustained investment
- High payoff potential
- 25% -> 50% of 6.1

Smart Structures

Intelligent Systems

Armor Materials by Design



Nanoscience

Compact Power Sources

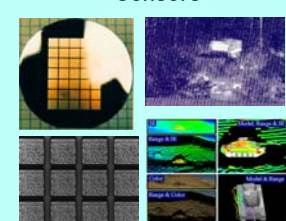
Enhancing Soldier Performance



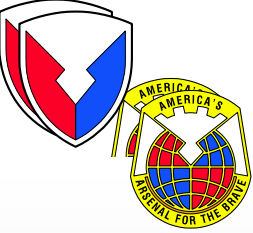
Biomimetics

Mobile Wireless Comm

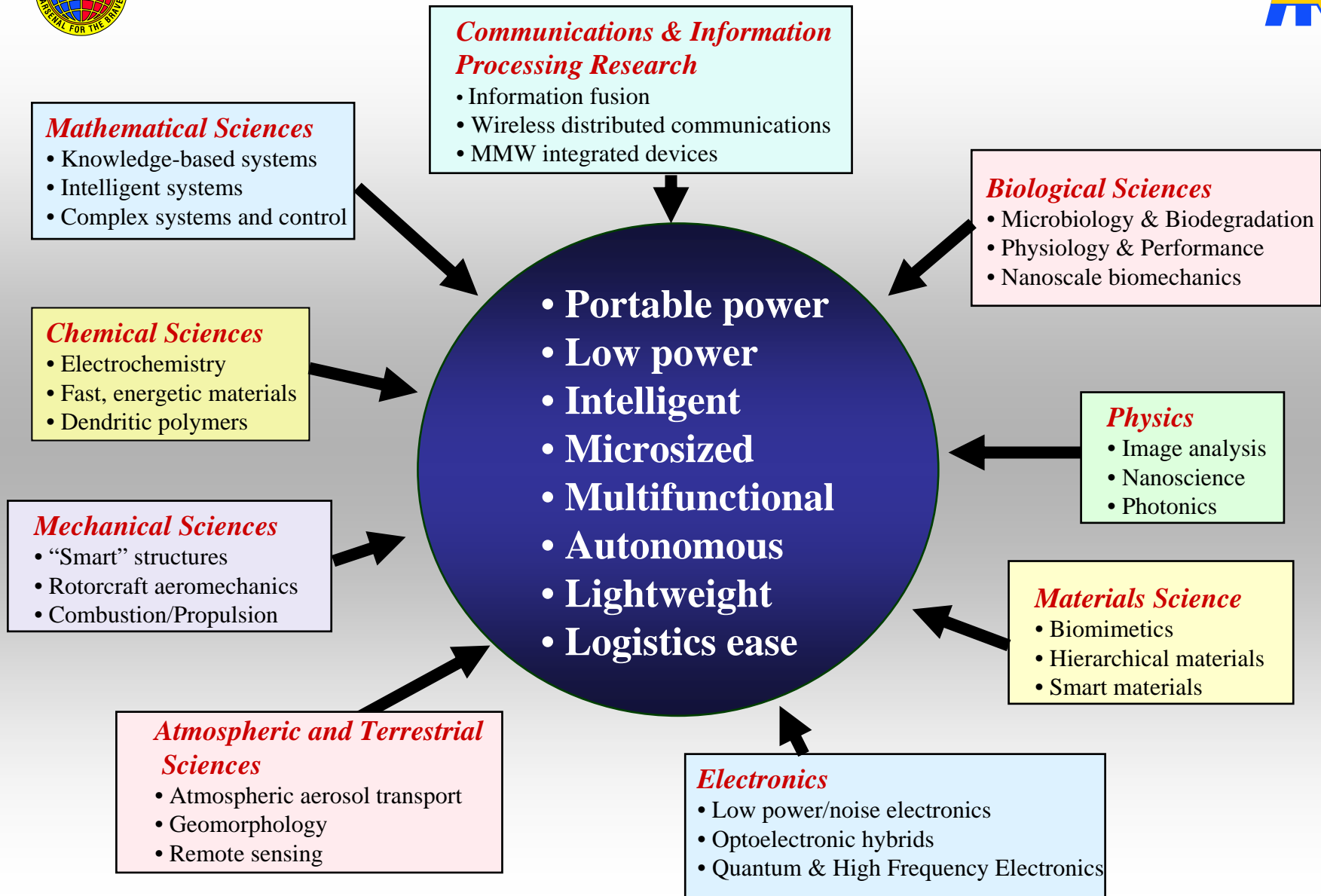
Microminiature Multifunctional Sensors



Creating Options for an Uncertain Future

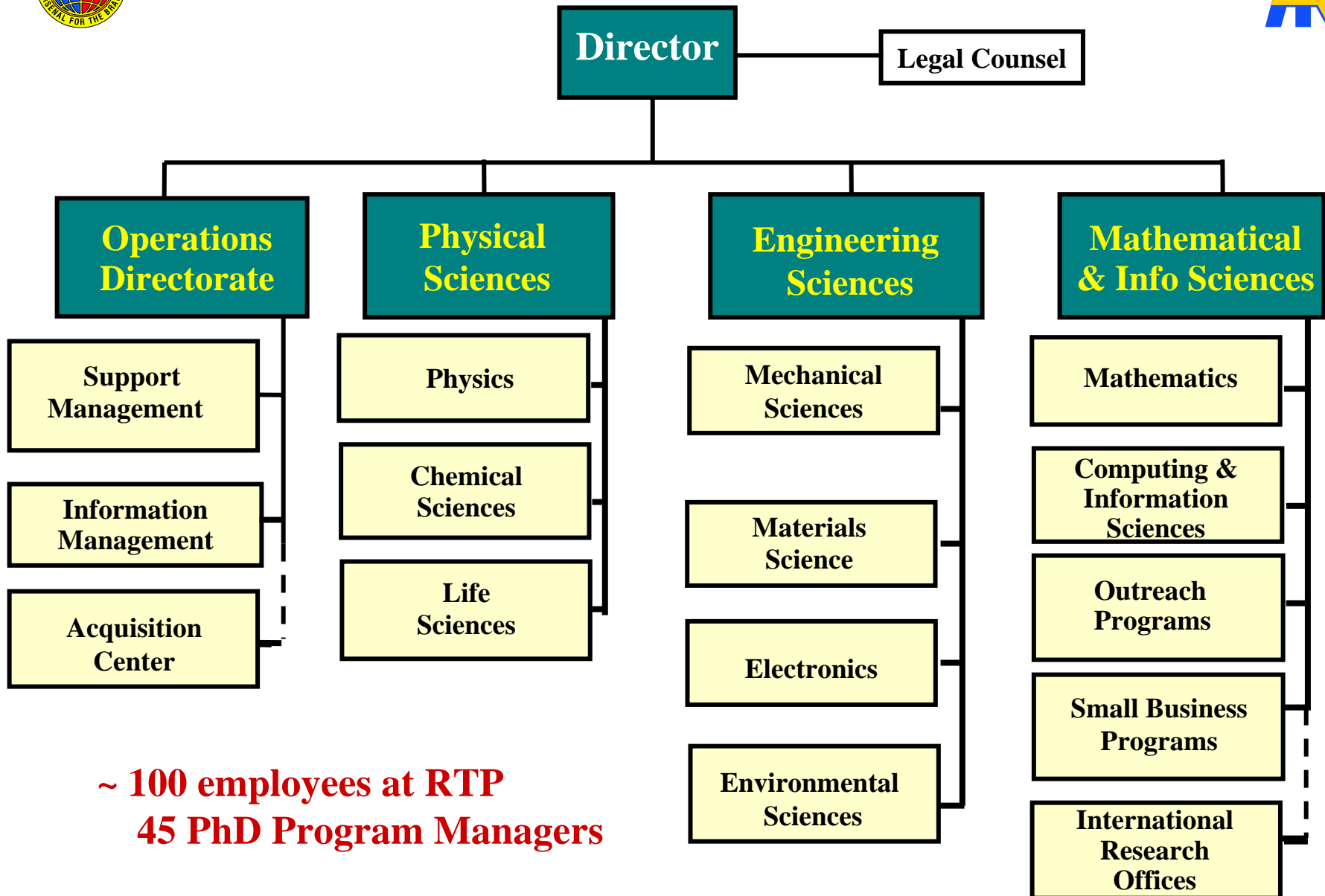


ARO Basic Research Pursuits





Army Research Office



~ 100 employees at RTP
45 PhD Program Managers



Fluid Dynamics



Thrusts:

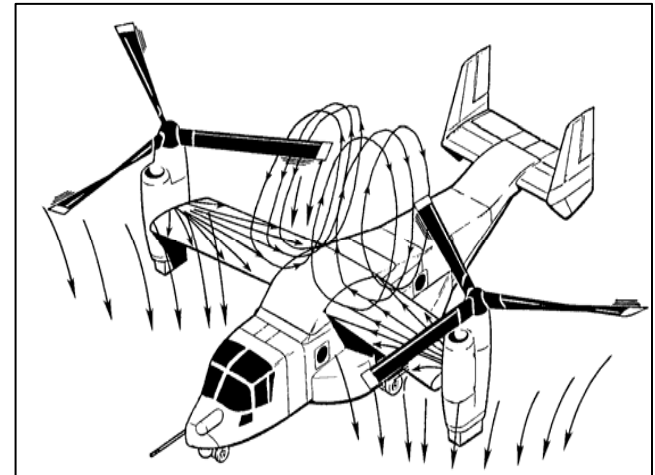
- Vortex Dominated Flows (Rotorcraft Wakes)
- Unsteady Aerodynamics
 - Maneuvering Missiles and Projectiles
 - Dynamic Stall/Unsteady Separation
 - Parachute Opening
- Thermal Science of Micro/Meso Devices

POC:

Dr. Thomas L. Doligalski

(919) 549-4251

thomas.doligalski@us.army.mil



Micro Active Flow Control of tiltrotor downwash flowfield yields 20% payload increase



Solid Mechanics



Thrusts:

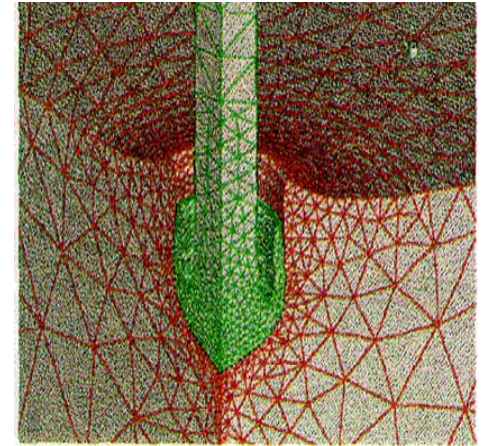
- **Mechanics of Heterogenous Systems**
 - **Multiscale Mechanisms**
 - **Nano- and Micro-Engineered Heterogeneous Systems**
 - **Interfacial Effects**
 - **Size Effects**
 - **Reliability**
 - **Wave propagation: dispersion, dissipation and attenuation**
- **Computational Solid Mechanics**
 - **Advanced Algorithms**
 - **Large-scale three-dimensional modeling and simulations**
 - **Nonlinear Optimization for Systems Design**
- **Mechanics of Fracture and Failure**
 - **Damage and Failure Processes**
 - **Bridging Scales**
- **Impact, Penetration and Shock**
 - **Advanced Experimental Techniques**
 - **Innovative Structures**

POC:

Dr. Bruce LaMattina

(919) 549-4379

bruce.lamattina@us..army.mil



**Three Dimensional Modeling
and Simulation of KE
Penetrators and Armor
Materials During Ballistic
Impact**



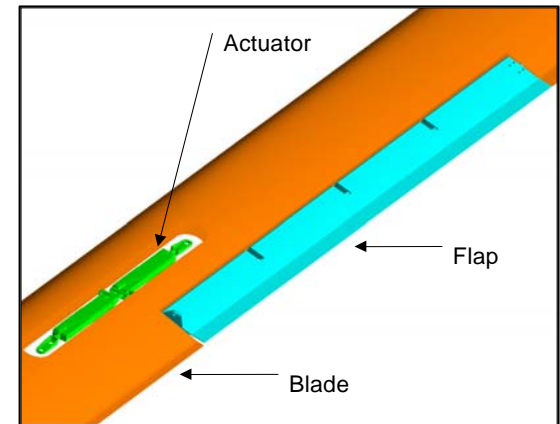
Structures and Dynamics



Thrusts:

- **Dynamics and Structural Mechanics of Air Vehicles**
 - Rotorcraft Aeromechanics Analysis: Modeling and Computational Aspects
 - Active Control of Rotary Wing Systems
 - Reliability and Durability of Air Vehicles
 - Improved Power Density Rotorcraft Drive Systems
 - Structural Health Monitoring
 - Projectile Aeroelasticity, Missile Dynamics, and Control
 - Parachute Aeromechanics
- **Structural Mechanics of Weapon and Ground Vehicle Systems**
 - High Speed and Precision Weapon System Pointing
 - Multi-Body Dynamics and Vehicle Simulation
 - Physics-Based Reliability Modeling of Ground Vehicles
- **Structural Modeling and Simulation**
 - Smart Structures
 - Structural Mechanics and Dynamics
 - Structural Damping
 - Active Structural Control
 - Inflatable Structures

POC: (Currently Vacant, Dr. Bruce LaMattina, Acting PM)
Dr. Gary Anderson (Retired, November 3, 2005)
(919) 549-4317
gary.l.anderson@us..army.mil



Smart structures for on-blade control yields 50% reduction in vibration amplitudes



Propulsion and Energetics



Thrusts:

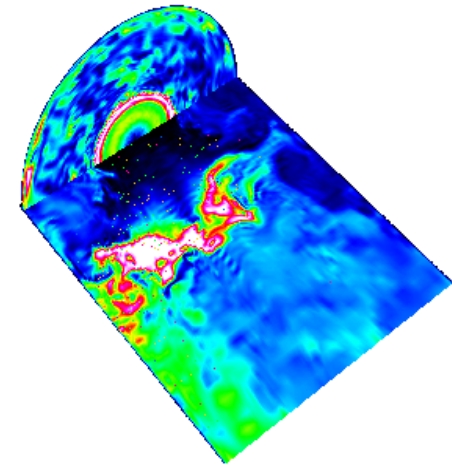
- **Turbine Engine Propulsion Research**
 - Critical Processes for Small Gas Turbine Engines
 - Active Control of Combustion and Dynamics in Small Turbine Engines
- **Reciprocating Engine Research**
 - Thermal Management in Ultra-Low Heat Rejection Combustion Environments
 - Active Air/Fuel Management
 - Cold Start Phenomena
- **Advanced Gun and Missile Propulsion**
 - Fundamentals of Ignition/Initiation and Combustion/Detonation Dynamics of Solid Gun Propellants
 - The Role of Nanomaterials and Nanostructures in Advanced Gun Propellant Performance and Vulnerability
 - Enablers for High Performance Solid Propellant Charge Concepts
 - Advanced Missile Propulsion
 - Novel Propulsion Approaches
- **Soldier Thermal Protection (Thermal Analysis of Flame/Thermal Protection Systems)**

POC:

Dr. David Mann

(919) 549-4249

david.mann1@us.army.mil



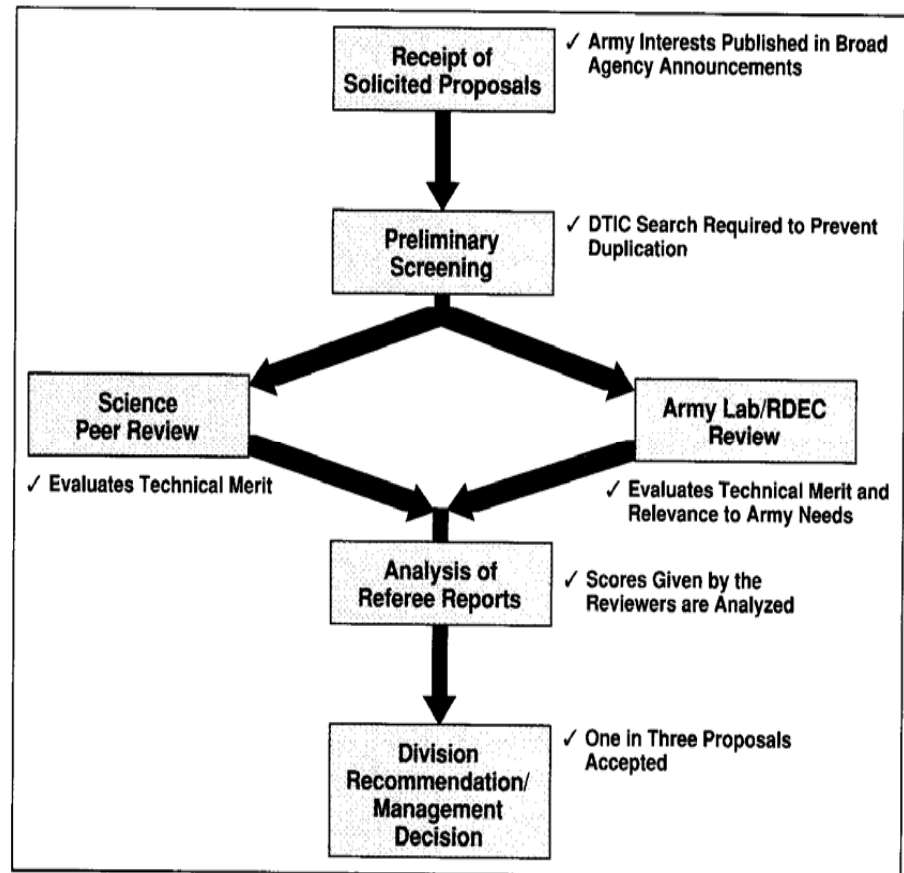
Large Eddy Simulation of Swirl Combustor



Single Investigator Program (Core Program)



- **Broad Agency Announcement**
- **Initial pre-proposal/program manager contact strongly encouraged: deadline is 15 October**
- **Funding cycle**
 - **March-April proposal receipt is optimal**
- **Two-tiered external review**
 - **scientific merit**
 - **Army relevance**





How to Survive/Thrive in the Funding Game*



- What's different about a mission agency?
- Making initial contacts and visits.
- How much do you need to know about applications of your research?
- Writing an irresistible proposal.
- Finding support for what you want to do vs. trying to do what you can get support for.
- Reading a Broad Agency Announcement.
- Accessing special programs.

Based partly on a survey of 14 Program managers in condensed matter physics/ materials, from NSF, DOE, AFOSR, ARO, ONR, DARPA

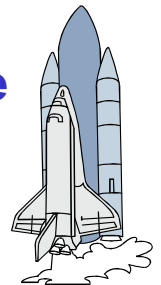
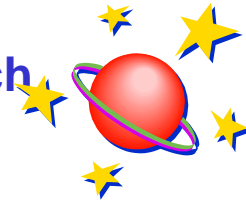
- *Does not reflect the official position of US Navy, US DoD, or US Government



What's different about a mission agency?



- **Non-mission agency** – e.g., National Science Foundation
 - Supports the development of new knowledge
 - Education component is integrated with research
 - Programs with special goals
 - All proposals reviewed
- **Mission agencies** – e.g., DoE Basic Energy Sciences, Air Force Office of Scientific Research, Army Research Office, Office of Naval Research, Defense Advanced Research Program Agency, etc.
 - Foster research in specific areas that support the mission of department or service
 - Missions are delineated by congress
 - Proposal may be rejected without review for lack of relevance





Making initial contacts and visits



Is a personal visit useful in advance of proposal submission?

- Program managers prefer e-mail or telephone.
- Also, try to meet program managers at conferences, or ask to be invited to program reviews.



Is it useful to submit a pre-proposal?

- Yes (essential, required, very important) ONR, AFOSR, ARO, DARPA
- Not encouraged (only to check relevance) DoE
- No NSF

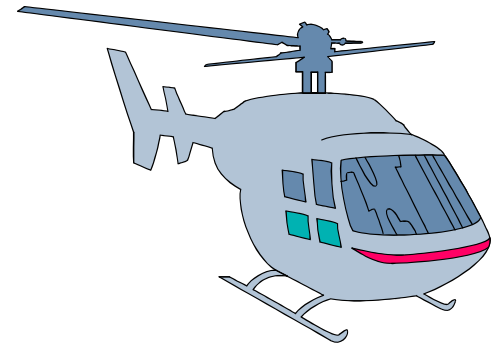
Make contacts with laboratory personnel of mission agencies. They are often used as reviewers, and are good sources for learning about applications and relevance.



How much do you need to know about applications of your research?



- **For Mission Agencies**
- it is **essential** that work fits in *mission area*, but this should be determined in advance of proposal submission
 - Read agency web pages. Visit Army laboratories.
 - Talk to program managers.
 - Watch for who funds related work.
- **For NSF**
 - Education, and other special program goals (diversity, international, industry interest)
 - Criterion # 1 Intellectual Merit
 - Criterion # 2 Broader Impact





Writing an irresistible proposal. What's in it?



- **Objective/goals/hypothesis**

- Need credible *hypothesis*.
- Don't just list series of tasks, without overarching concept, demonstrate you know the “scientific method”
- Fatal if proposed work is too small a step forward



- **Background**

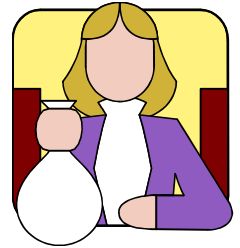
- Need to demonstrate knowledge of previous and current work. Define state-of-art that you will advance
- Describe a vision of where field is going and how your proposed work fits
- Summarize contents of cited articles, don't assume reviewer knows them.



Writing an irresistible proposal. What's in it? (cont.)



- **Approach/work statement**
 - Describe actual work to be done
 - Show that you can do the work (list needed equipment, collaborators, etc.)
 - Have a research plan, give a results time line (3 month increments)
 - Give sufficient detail to determine “bang for bucks”
- **Administrative completeness**
 - Fatal in special programs with deadlines
 - Identify if proposal submitted to multiple agencies





Writing an irresistible proposal

General advice



- Infect reviewer with enthusiasm for work. Try to induce reviewer curiosity about outcome.
- Have original ideas. Don't propose to duplicate work in progress. Funding limitations often preclude funding multiple approaches.
- Describe impact. Where will field be if all objectives are met?
- Be able to defend cost items in budget in terms of efforts. Program managers do not give away money, they support efforts.
- Ask for feedback on unsuccessful proposals.



Writing an irresistible proposal

Special advice for young investigators



- You don't have a track record. The reviewer doesn't know you. YOU should be revealed in proposal.
- It's probably a bad idea to justify something because "everyone is doing it" or "it is an area of great current interest"
- Not everything that can be known is worth knowing, or worth the resources to find it out.
- Don't say you will "study" or "investigate"



**Finding support for what you want to do vs.
trying to do what you can get support for.**



Do's

- **Participate in conferences and workshops funded by agencies**
 - *It is useful for you to hear talks by proposers/performers at conferences.*
 - **Be aggressive to find the right program manager.**
- **Keep trying! Persistence demonstrates persistence.**
- **Consider spending summer in a government laboratory or industry.**
- **Enjoy your work and let that enjoyment show.**





Finding support for what you want to do vs. trying to do what you can get support for.



Don'ts

- Don't ask program manager what he/she would like you to do.
- Don't talk endlessly about capabilities.
- Don't ask program manager how much funding you should ask for. The program manager can offer budget guidance based on resource limitations.
- Don't ask program manager what he/she currently funds (You can find that out elsewhere.)





Broad Agency Announcement



Broad Agency Announcement (BAA) outlines area of investigation for which agency would like to receive proposals, published in Commerce Business Daily

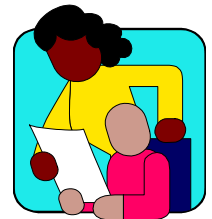


- **“General” funding agency BAA**
 - open for up to a year, “rolling” submissions till funds gone.
 - Covers many topics (often referenced to agency web site)
 - All submitted proposals are competitive with each other
- **Laboratory BAA**
 - Allows laboratory to fund contracts or grants for collaborations, services, etc.
 - Not usually a general call for proposals



Broad Agency Announcement (contd.)

- **Specific BAA's and Special Program Announcements** (Instrumentation, DEPSOR, Young Investigators, Centers, etc.)
 - Absolutely firm deadline for proposal submission (specific date and time of day)
 - Do not submit unless you meet all criteria, omissions cannot be corrected
 - Determine and address all evaluation categories (rigid scoring prevails)
 - Identify type and amount of cost-sharing, if any
- **Letters of recommendation and support**
 - Institutional support may be an evaluation criterion
 - Should supplement, not repeat information in proposal





Evaluation Criteria: an Example DoD Multi-Disciplinary University Research Initiative (MURI)



The primary evaluation criteria, of equal weight, are:

- (1) Scientific and technical merits of the proposed basic science and/or engineering research;**
- (2) Relevance and potential contributions of the research to defense missions;**
- (3) Impact of plans to enhance the institution's ability to perform defense-relevant research and to train through the proposed research, students in science and/or engineering (for example, by acquiring or refurbishing equipment that can support DoD research and research-related educational objectives.**



Evaluation Criteria: an Example DoD Multi-Disciplinary University Research Initiative (MURI) (contd.)



The other evaluation criteria, of lesser importance than (1), (2), and (3) but equal to each other, are:

- (4) The qualifications and availability of the principal investigator and other key research personnel;**
- (5) The adequacy of current or planned facilities and equipment to accomplish the research objectives;**
- (6) The impact of interactions with other organizations engaged in related research and development, in particular industrial organizations, DoD laboratories and other organizations that perform research and development for defense applications;**
- (7) The realism and reasonableness of cost. Cost sharing is not a factor in the evaluation.**



Some Useful Web Sites



Army Laboratories


Army Research Office and Army Laboratories (mechanical sciences)

- www.aro.army.mil
- www.arl.army.mil/vtd/vtc-intr.html
- www.aatd.eustis.army.mil
- www.pica.army.mil
- www.redstone.army.mil
- www.tacom.army.mil
- www.arl.army.mil/main/Main/default.html



<http://www.aro.army.mil>

Aro Home



Institute for Soldier Nanotechnologies
Solicitation Amendment 0001

For the Public

- Mission Statement
- Director of ARO
- Support Personnel
- People of ARO
- ARO Washington
- ARO Far East
- ARL- ERO
- News and Information
- Publications
- Employment
- Visitor Info
- ARO Cool Links
- Accomplishments

For the Researcher

- ARO Program

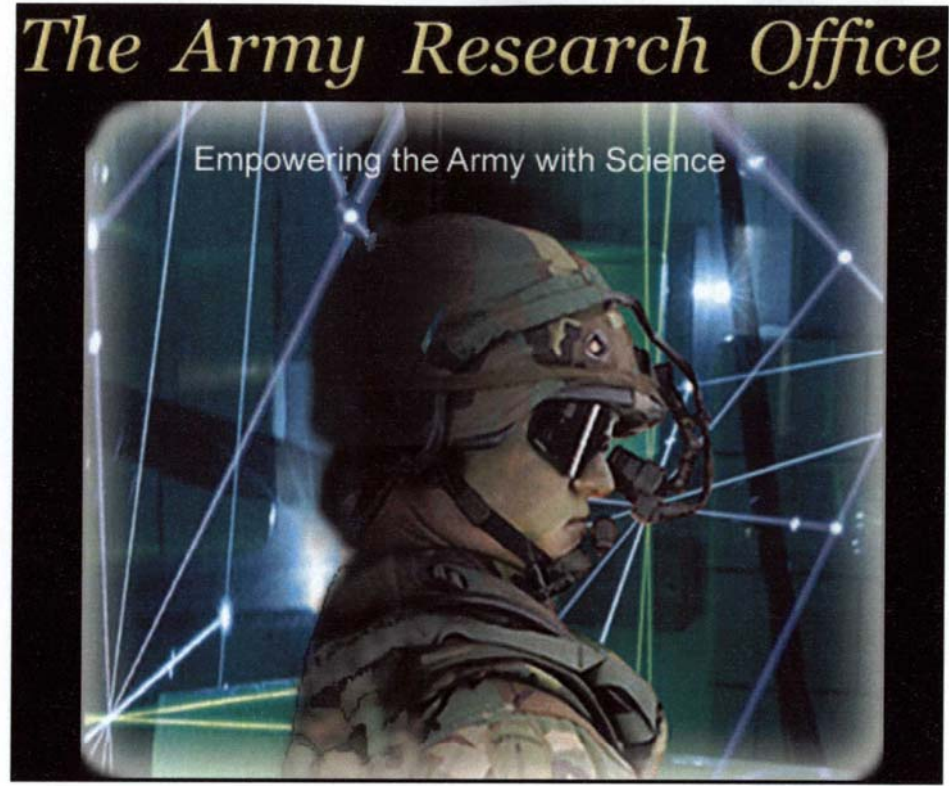
Divisions

- RTI Directorate
- Funding

Opportunities

- Annual BAA
- Reporting Instructions
- Forms

Please provide feedback to:



Institute for Soldier Nanotechnologies
Solicitation Amendment 0001

BAA Solicitation | Mission | Director of ARO | Organization
Support Personnel | People of ARO ARO-Wash | ARO Far East
ARL-ERO | News & Information | Publications | Employment
Visitor Information | Cool Links | Accomplishments | Scientific Directorates
Research & Technology Integration Directorate | Funding Opportunities
Annual BAA | Reporting Instructions | Forms