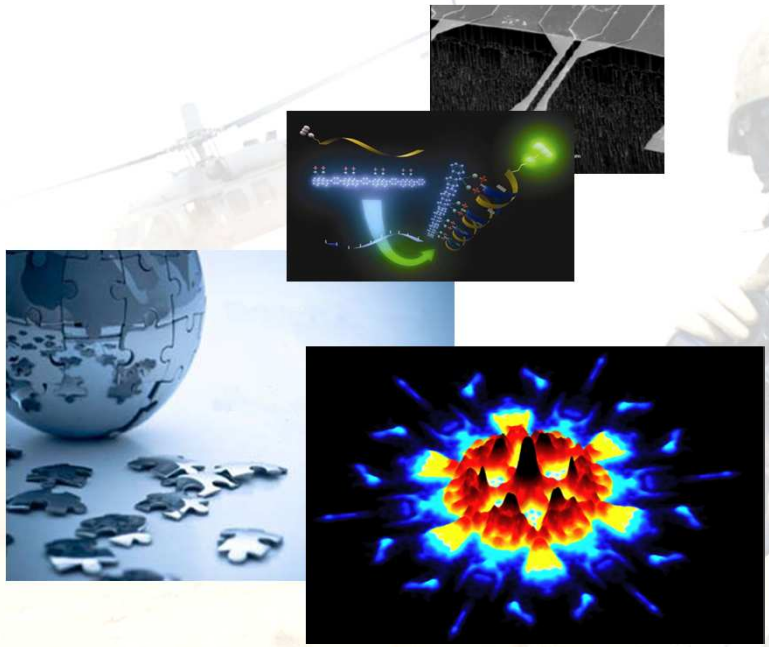
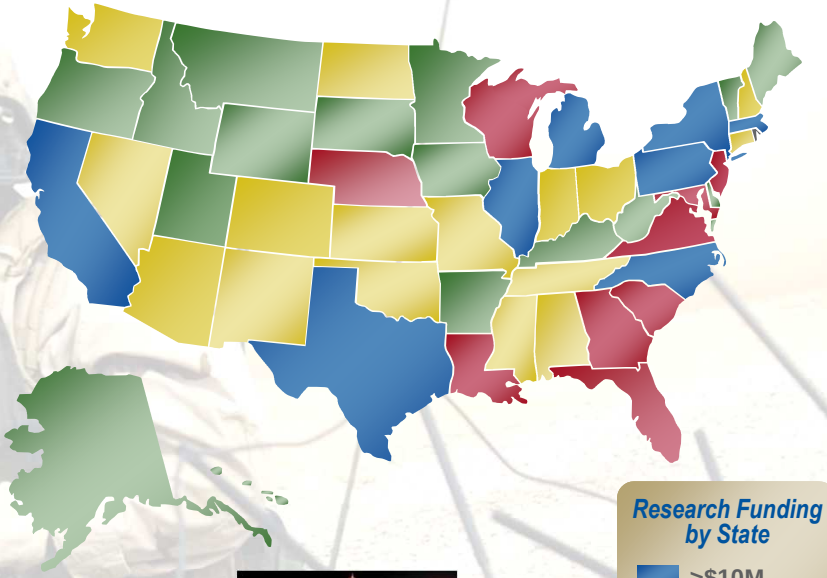
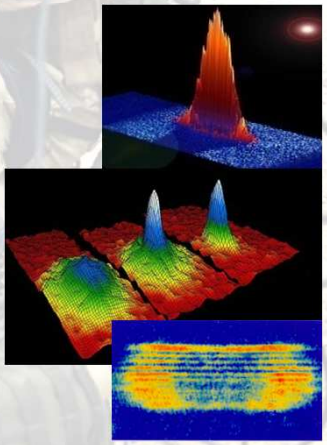
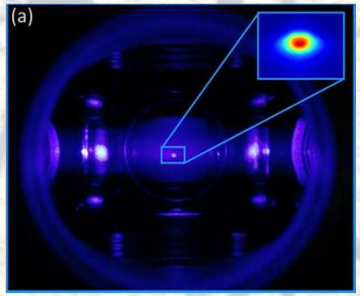
ARO Basic Research









Dr. Thomas L. Doligalski
Director
Engineering Sciences Directorate
US Army Research Office
http://www.aro.army.mil

5 March 2012

Problems listed in no particular order

Big Army Problems
"Soldier as the Decisive Edge"

1. There is insufficient FORCE PROTECTION to ensure highest degree of survivability across the spectrum of operations.

2. Soldiers in Small Units (squads/fire teams/crews) are OVERBURDENED (physically and cognitively); this degrades performance and may result in immediate, as well as, long term consequences.

3. U.S. Army squads are too often SURPRISED in tactical situations. Soldiers in Small Units lack sufficient timely MISSION COMMAND & TACTICAL INTELLIGENCE to understand where their assets are, who and where the enemy is, who and where non-combatants are and to document and communicate this information to each other and higher echelons.

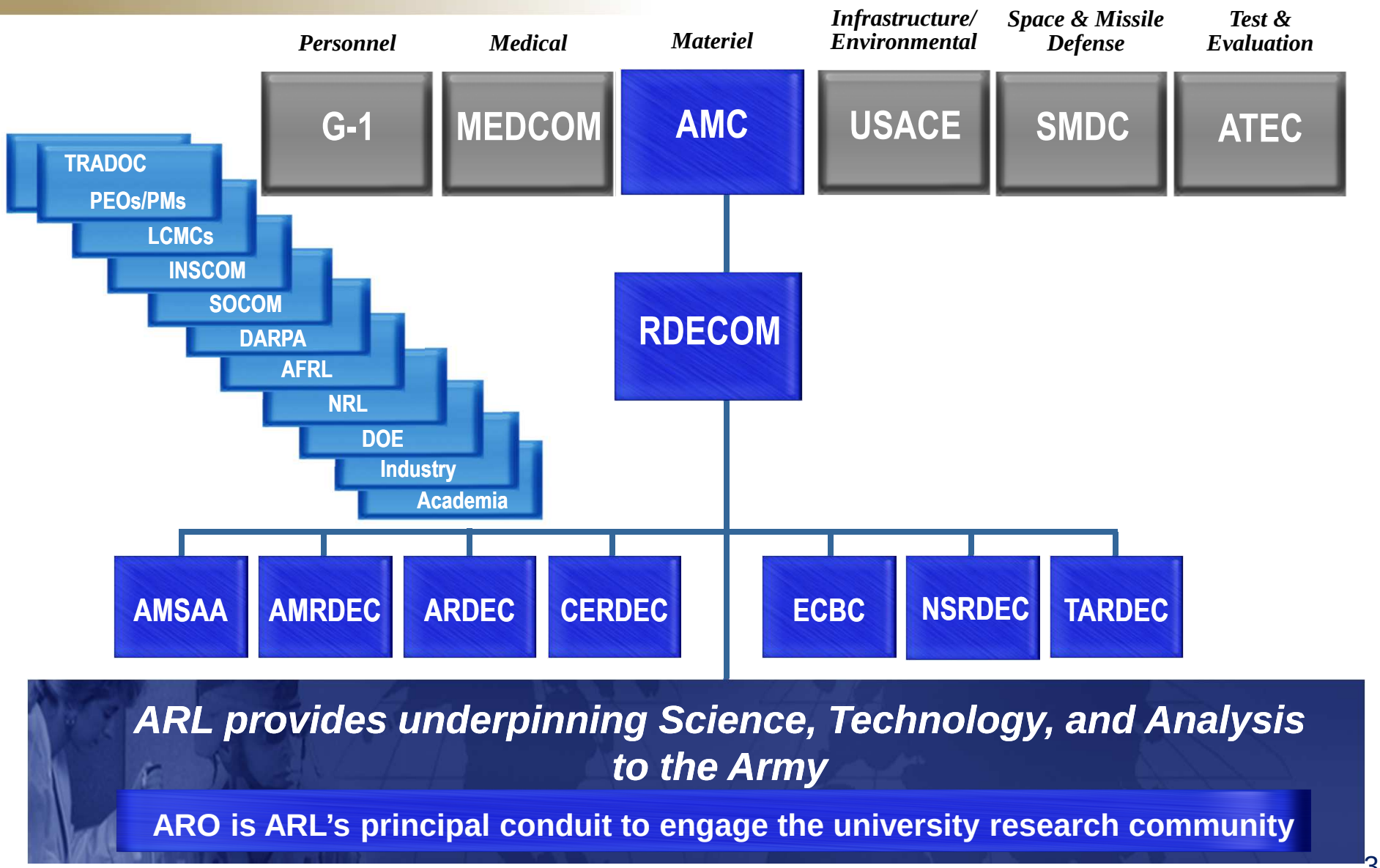
4. We spend too much time and money on STORING, TRANSPORTING, DISTRIBUTING and WASTE HANDLING of consumables (water, fuel, power, ammo and food) to field elements, creating exposure risks and opportunities for operational disruption.

5. Soldiers in Small Units have limited capability to integrate maneuver and fires in all environments to create TACTICAL OVERMATCH necessary to achieve mission objectives.

6. Operational MANEUVERABILITY (dismounted & mounted) is difficult to achieve in complex, austere, and harsh terrains and at high OPTEMPO.

7. We do not understand WHAT MAKES THE HUMAN TICK in a way that can lead to assured ability to perform operational, high OPTEMPO missions effectively and without secondary negative effects.

RDT&E Performing Organizations



ARL provides underpinning Science, Technology, and Analysis to the Army

ARO is ARL's principal conduit to engage the university research community

U.S. Army Research Laboratory

Director
Mr. John Miller

Deputy Director for Basic Science & Director ARO
Dr. David Skatrud

Associate Director for Plans & Programs
Dr. Cary Chapalowski

Associate Director for Science & Technology
Dr. Ozden Ochoa

Associate Director for Laboratory Operations
Ms. Teresa Kines

Military Deputy
COL John Shanklin

Sergeant Major
Christopher Harris

Vehicle Technology

Human Research & Engineering

Survivability/ Lethality Analysis

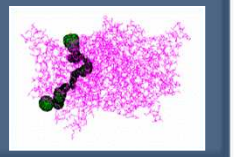
Computational & Information Sciences

Sensors & Electron Devices

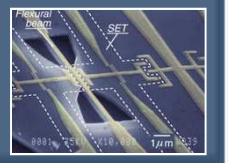
Weapons & Materials Research

Army Research Office

Information Sciences

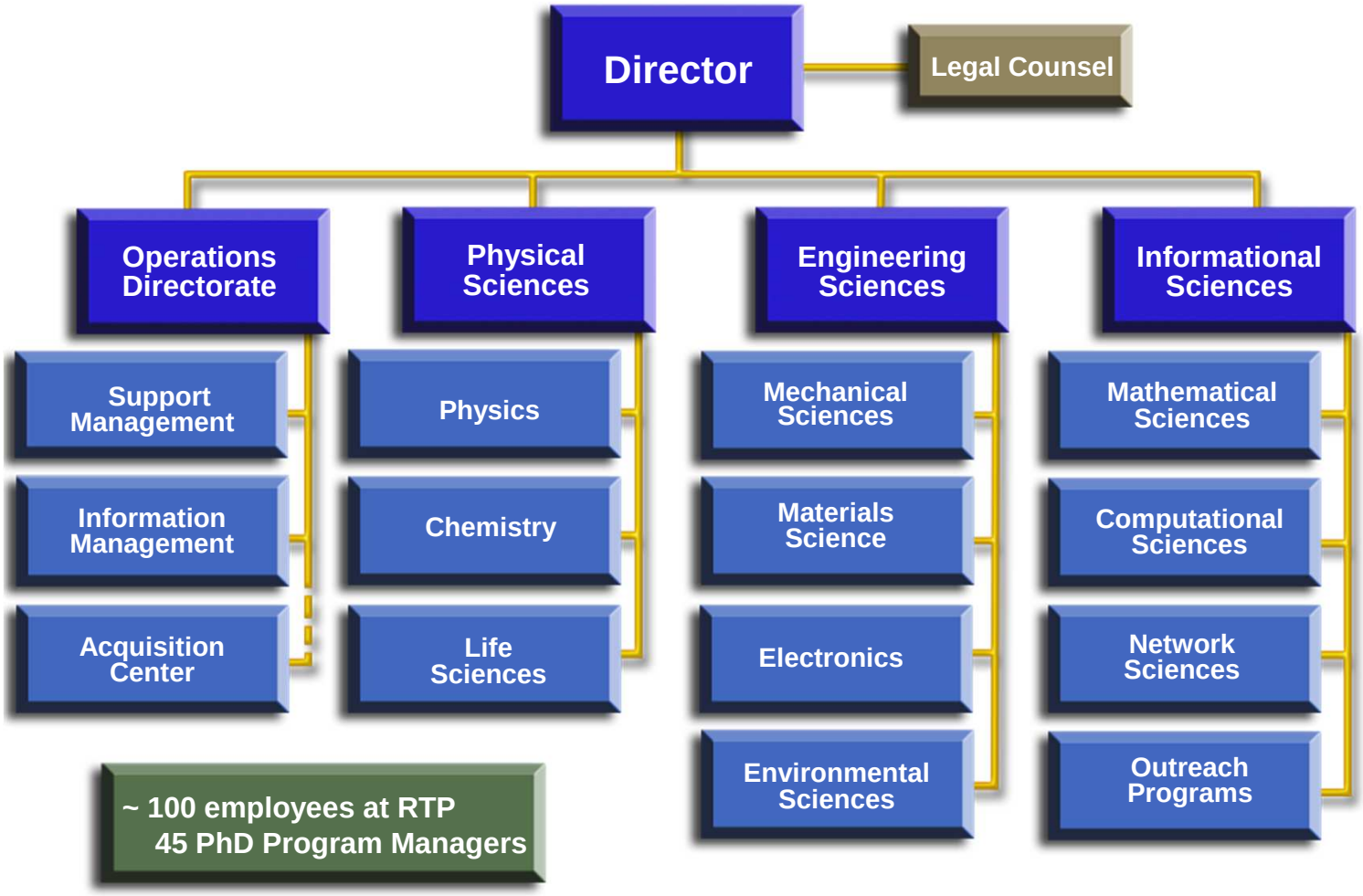


Physical Sciences

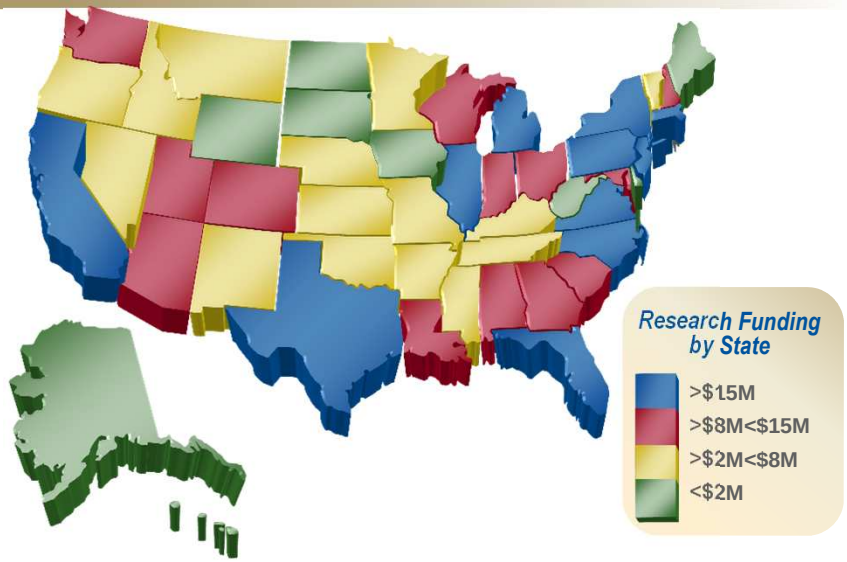


Engineering Sciences

Army Research Office Organization



Army Research Office Mission



- 256 Institutes of Higher Learning
- 861 individual Investigators
- 47 Research Centers

Research Area	
Chemistry	Materials
Computing & Info Science	Mathematics
	Mechanics
Electronics	Network Science
Environmental	Physics
Life Sciences	

Utilize the vast intellectual capital of our nation's universities to:

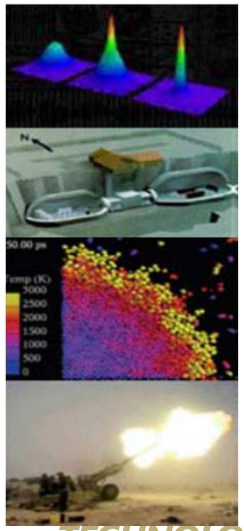
Exploit Scientific Opportunities for Revolutionary New Army Capabilities

Drive Science to Develop Solutions to Existing Army Technology Needs

Accelerate Transition of Basic Research

Strengthen University, Industry, Government Partnerships

Educate and Train the Future S&E Workforce for the Army



Research ranges from atom optics for underground bunker/tunnel detection to nano-energetics for more powerful and insensitive munitions and propellants

Basic Research's Critical Role

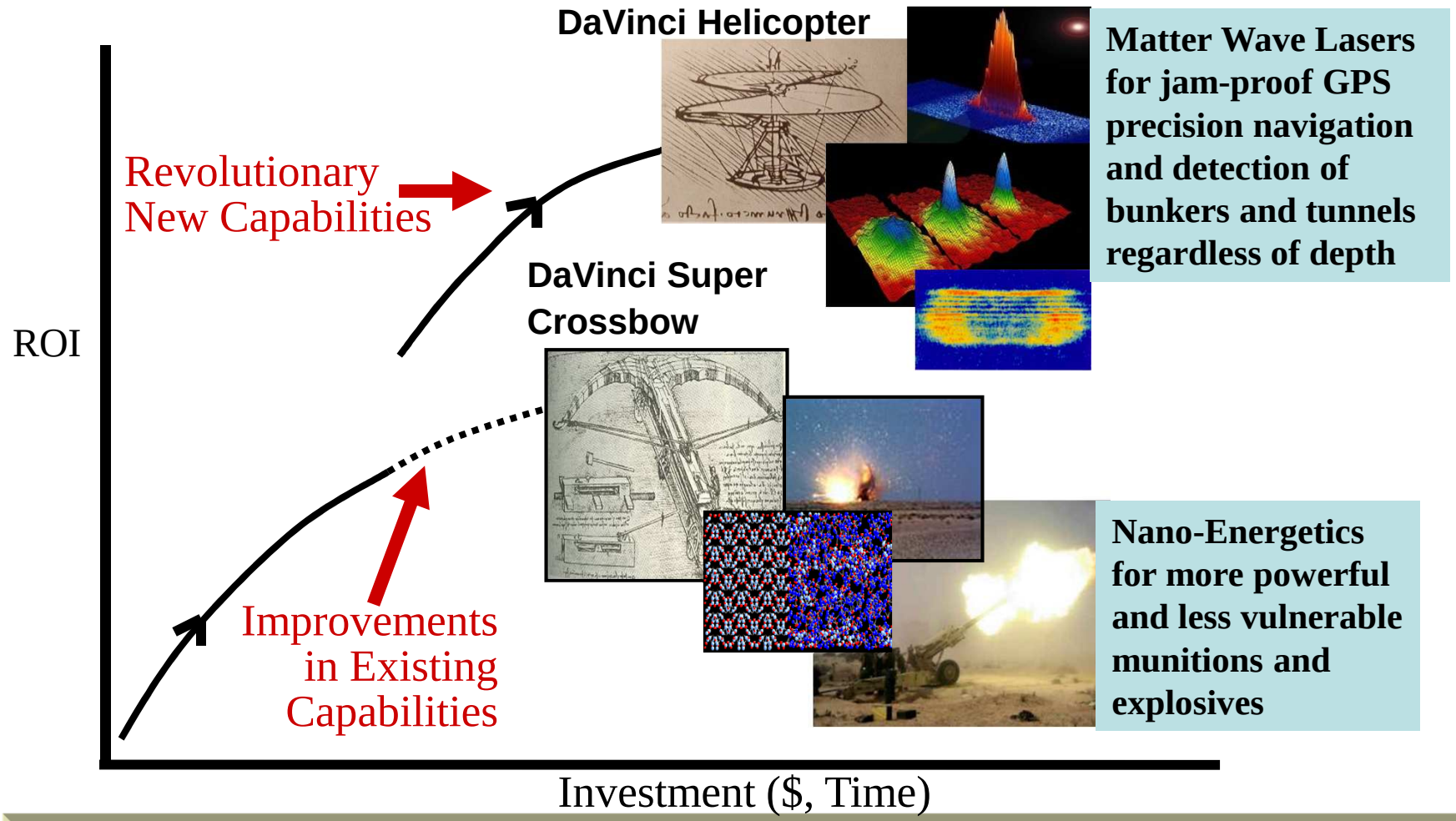
"None of the most important weapons transforming warfare in the 20th century - the airplane, tank, radar, jet engine, helicopter, electronic computer, not even the atomic bomb - owed its initial development to a Doctrinal Requirement or request of the military."

John Chambers, ed., The Oxford Companion to American Military History (New York, Oxford University Press, 1999) p. 791

DoD extramural basic research is the critical source of revolutionary science/engineering:

- *Identify/ formulate / create*
- *Nurture / fund / guide*
- *Disseminate / transition*

ARO Spans the Basic Research Continuum



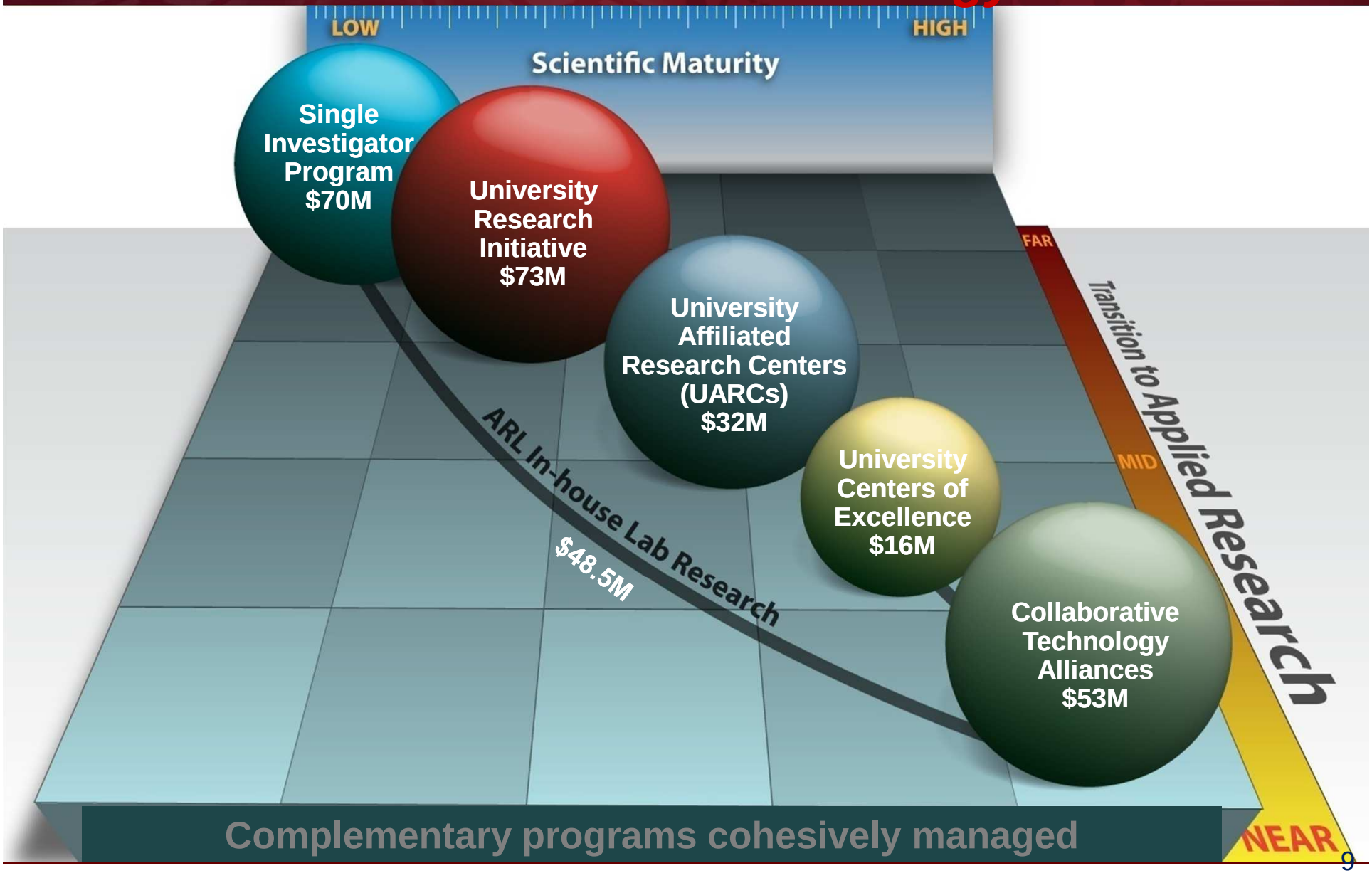
Matter Wave Lasers for jam-proof GPS precision navigation and detection of bunkers and tunnels regardless of depth

Nano-Energetics for more powerful and less vulnerable munitions and explosives

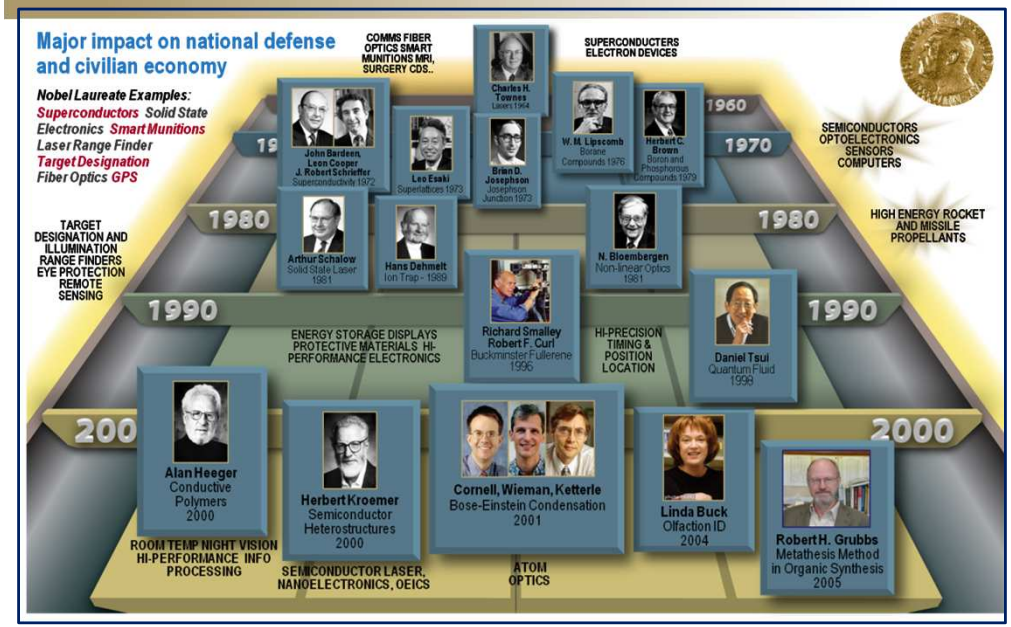
Generates the New Knowledge Required to Maintain Technological Superiority

- **Discovers and creates new science that produces revolutionary new capabilities**
- **Applies innovative scientific advances to improvements in critical existing capabilities**

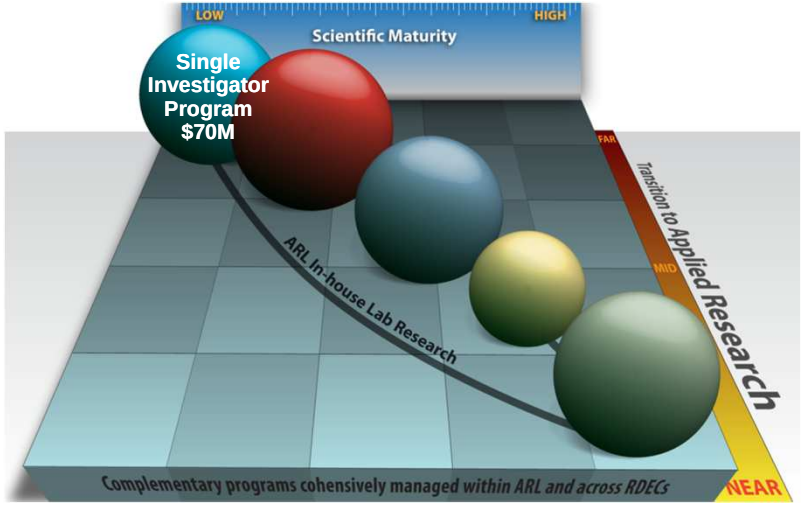
ARO Basic Research Portfolio
From Ideas to Technology



Single Investigator Program Leverages World-Class Academic Expertise



Exploit the innovation and flexibility of academia

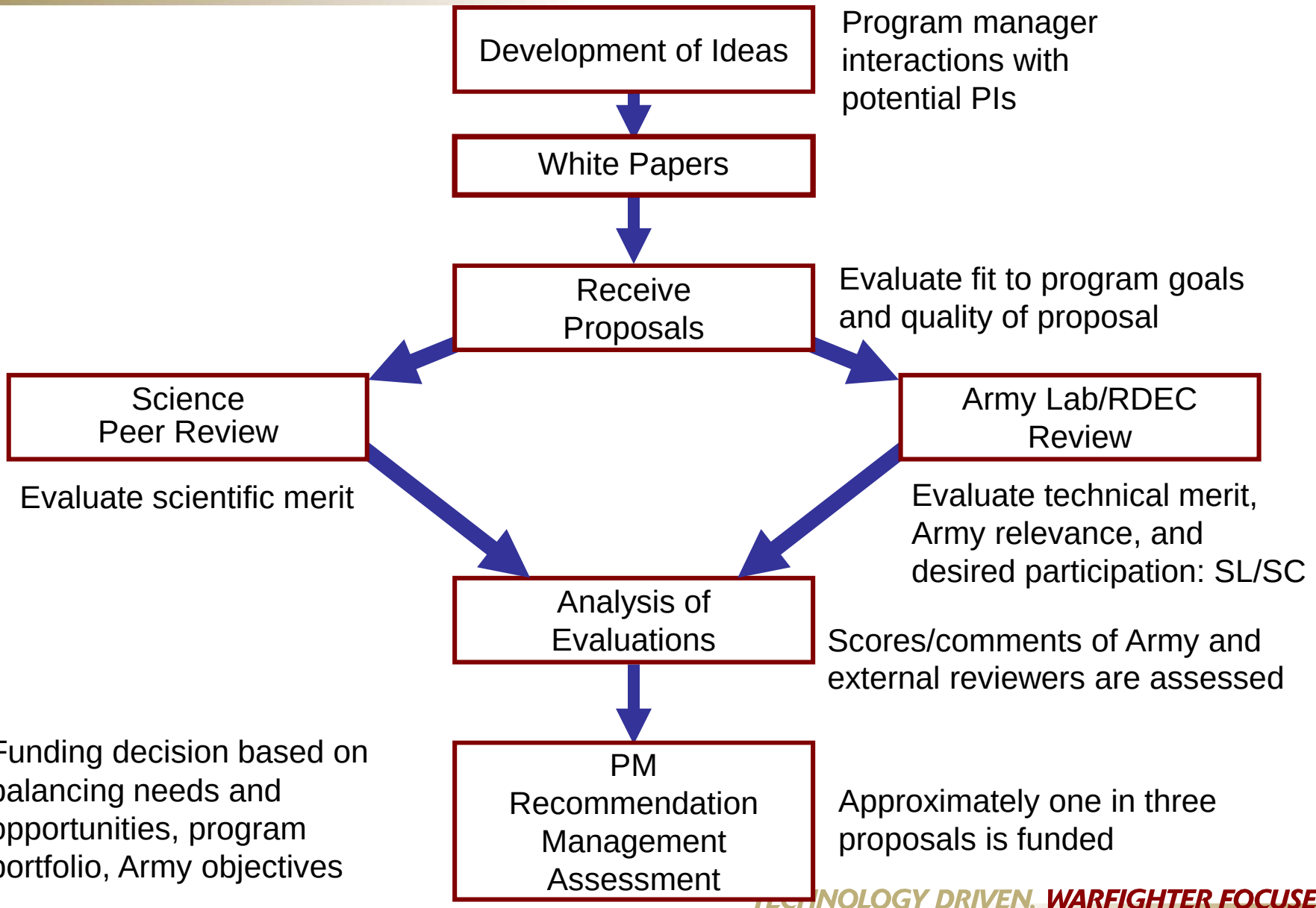


6.1 Dollars

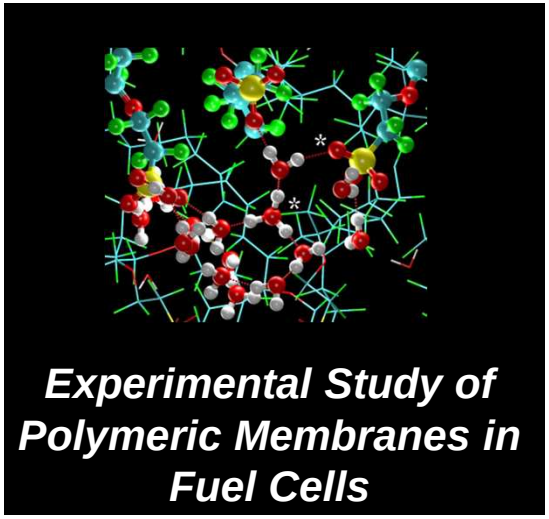
($M)	FY11	FY12	FY13	FY14	FY15
61102	70.7	74.2	77.2	77.5	77.1

- ***Rapid and agile exploitation of novel science opportunities world-wide***
- ***Extremely cost-effective***
- ***All states and D.C.***
- ***>250 institutions***
- ***3 year grants; no automatic renewal***
- ***Graduate students supported: ~1400***
- ***~ 900 university grants, $115k/yr grant***

SI Proposal Evaluation, Selection, and Monitoring



University Research Initiative



Experimental Study of Polymeric Membranes in Fuel Cells

($M)	FY11	FY12	FY13	FY14	FY15
61103	73.2	74.9	78.9	81.6	85.6

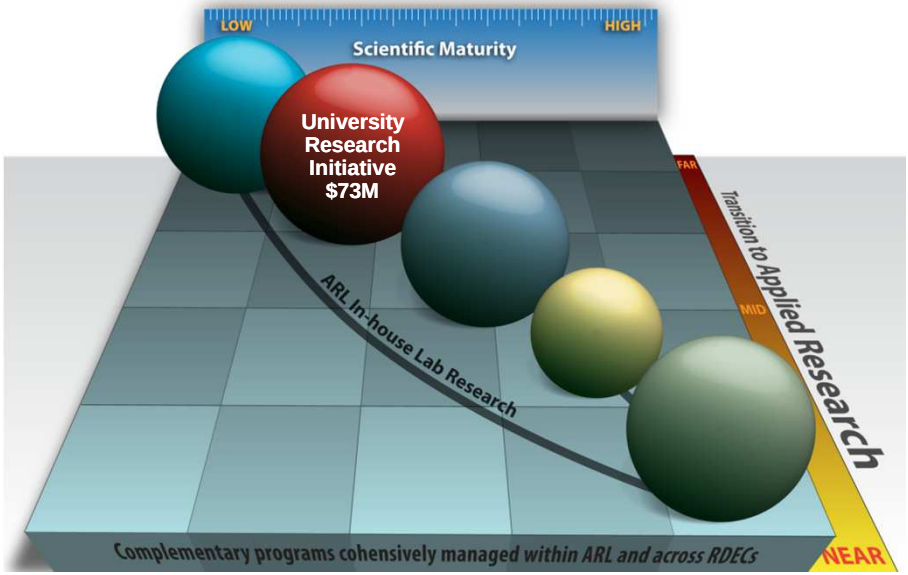
Includes -

MURI, DURIP, PECASE, MINERVA

Funds restricted to U.S. Universities

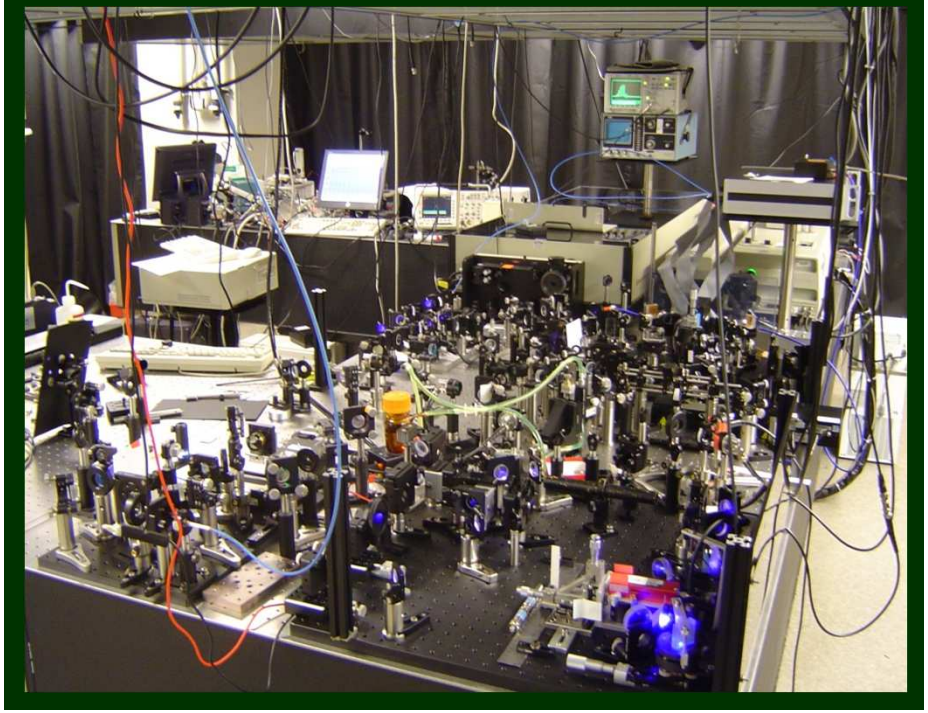
<u>Multi-Disciplinary University Research Initiative (MURIs)</u>

- ***Research vital to the Army, but applicable to multiple Services***
- ***Investigates high priority, transformational topics such as biologically inspired mobile networks of autonomous vehicles, self-assembling multifunctional ceramic composites***
- ***Critical mass of researchers; $1.25M/year, 5-years***
- ***Approximately 8 new initiatives started annually***
- ***RDEC/ERDC/MRMC input key in the determination of topics***



Defense University Instrumentation Program (DURIP)

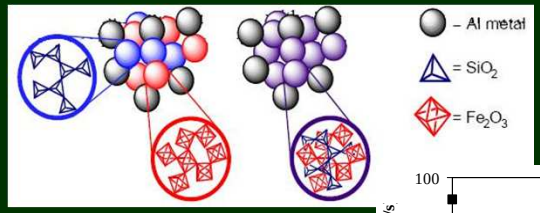
Optical table with broad-band laser for generation of fast, complex laser pulses for Quantum Molecular Control
H. Rabitz, Princeton University

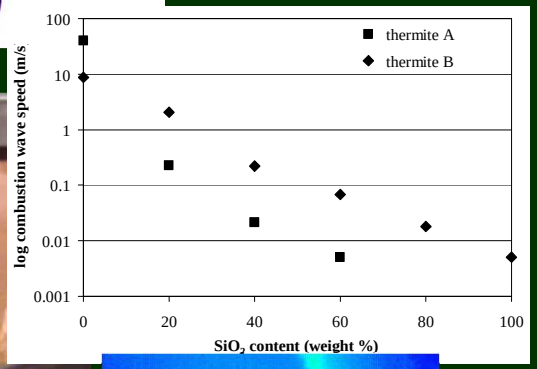


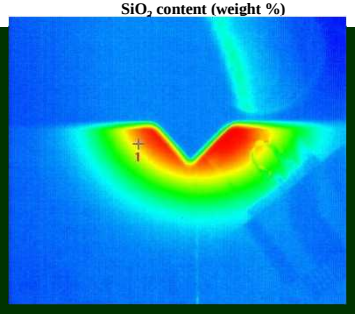
- ***Competitive grants awarded for the acquisition of research instrumentation***
- ***Emphasis is on instrumentation vital to the discovery of new science and the advancement of Army transformational technologies***
- ***Research instrumentation awards average approximately $200K each, $1M max per award***
- ***Allows researchers to take immediate advantage of fast paced instrumentation innovation***

Presidential Early Career Awards for Scientists and Engineers (PECASE)

Combustion and Ignition Studies of Nanocomposite Energetic Materials
PI: Michelle Pantoya, Texas Tech Univ.







- ***Supports single-investigator research efforts performed by outstanding academic scientists and engineers early in their independent research careers***
- ***Each recipient receives $200K per year for five years***

Former Army PECASE recipient