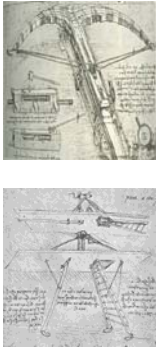


ARO Opportunity and Need Driven Examples

- **Extrapolation of Existing Technologies (Need Driven)**
 - Incremental, Continued Improvement in Existing Technologies
 - Often Driven or Enabled by Commercial Market
 - CPU on a chip
 - Inexpensive GPS
 - May be a "Disruptive Technology" (e.g. personal vs. mini computers)
- **Revolutionary New Applications from Scientific Breakthroughs (Opportunity Driven)**
 - Utilizes Two Somewhat Distinct Mechanisms
 - Fundamentally new approaches to solving old problems
 - Fundamentally new capabilities
 - Examples from Past
 - Navigation - Satellites and atom clocks for GPS
 - Range Finders and Target Designators - Lasers
 - Examples for the Future
 - Atom Optics for Jam-Proof Navigation
 - Quantum Informatics for Computation, Secure Communication, Imaging
 - Nano-energetics for propellants and explosives
 - Micro-active flow control



TECHNOLOGY DRIVEN, WARFIGHTER FOCUSED.

ARO 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

The details of this provocative quote can be debated; but it in any case, it is absolutely clear that RDEC and stakeholder input is critical for:

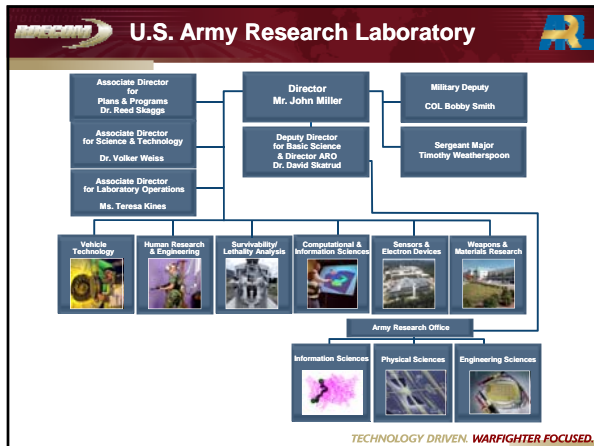
- Transitioning basic research
- Identifying needs-driven basic research
- And identifying revolutionary science/engineering

TECHNOLOGY DRIVEN, WARFIGHTER FOCUSED.

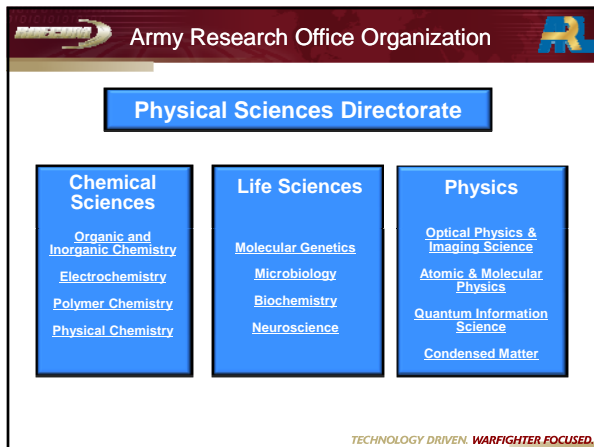
ARO Strategic Goals & Objectives

- Exploit scientific opportunities for revolutionary new capabilities
- Apply science to generate solutions to existing needs
- Prevent technological surprises
- Accelerate the transition of research to application
- "Honest Broker" for the Army for objective assessments
- Leverage S&T of outside sources for Army benefit
- Strengthen university, in-house, industry partnerships
- Foster S&E training in disciplines critical to the Army
- Enhance outreach efforts for greater intellectual diversity

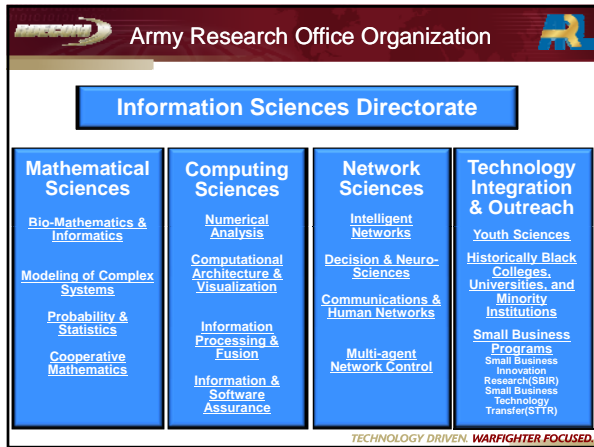
TECHNOLOGY DRIVEN, WARFIGHTER FOCUSED.

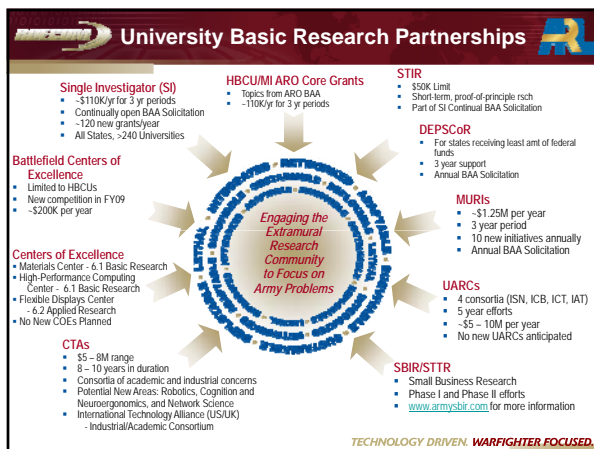












ARO Funded Nobel Laureates

Major impact on national defense and civilian economy

Nobel Laureate Examples:
 Superconductors, Solid State Electronics, Smart Munitions, Laser Range Finder, Target Designation, Fiber Optics, GPS

1962 SUPERCONDUCTORS, ELECTROLYSES
 Heike Kamerlingh Onnes (1854-1926)
 John Bardeen (1908-1992)
 Leon Cooper (1930-2019)

1970 SEMICONDUCTORS, OPTOELECTRONICS, SENSORS, COMPUTERS
 Leo Esaki (1918-2016)
 Herbert Kroemer (1928-2022)
 John Bardeen (1908-1992)

1980 HIGH ENERGY ROCKET AND MISSILE PROPELLANTS
 Robert G. Barrer (1918-2007)
 Harold Kroger (1918-2013)

1980 TARGET DESIGNATION AND ILLUMINATION, RANGE FINDERS, EYE PROTECTION, REMOTE SENSING
 Arthur Schawlow (1921-2013)
 Herbert Kroger (1918-2013)

1990 ENERGY STORAGE, DISPLAYS, PROTECTIVE MATERIALS, HI-PERFORMANCE ELECTRONICS
 Richard Smalley (1941-2021)
 Robert F. Curl (1933-2022)
 Buckminster Fuller (1893-1983)

1990 HI-PRECISION TIMING & POSITION LOCATION
 David T. Long (1924-2018)

2000 ROOM TEMP NIGHT VISION, HI-PERFORMANCE INFO PROCESSING
 Alan Heeger (1936-2023)

2000 SEMICONDUCTOR LASER, NANOELECTRONICS, ODECS
 Herbert Kroemer (1928-2022)
 Cornell, Wieman, Ketterle (2001)
 Linda Buck (1932-2023)

2000 ATOM OPTICS

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Questions?
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