MISSION: Identify, develop and demonstrate technology options that inform and enable effective and affordable capabilities for the Soldier

VISION: Providing Soldiers with the technology to Win

Current Force

- Deployable Force Protection Adaptive Red Team
- Advanced Rotary Wing Aerial Delivery Sling Load Net
- Autonomous Mobility Appliqué System
- High Speed Container Delivery System
- Video from Unmanned Aerial Systems

Future Force

- Cyber tools
- Next Generation Rotorcraft
- Neuroscience
- High Energy Lasers
- Combat Vehicle Prototyping

Enhancing the Current Force

Enabling the Future Force

MISSION: Identify, develop and demonstrate technology options that inform and enable effective and affordable capabilities for the Soldier

VISION: Providing Soldiers with the technology to Win
Roles of Science and Technology

S&T’s Impact on Technology Maturation

Technology Maturity

Time

Fundamental/Disruptive Technologies

INNOVATE

Investigate Technology

Innovate Technology Options

Applied Research

INNOVATE

Investigate Technology

Applied Research

Manned-Unmanned Teaming

Experimental Prototyping & Improve Current Systems

- Drive Down Technical Risk
- Inform Achievable Requirements

Manned-Unmanned Teaming

Quick Reaction

1-2 Years

Mid

Mid-Frame

Joint Multi-Role Technology Demonstrator

High Energy Laser – Tactical Vehicle Demonstrator

Aeromechanics and Computational Methods

Disruptive Energetics

Blast Protection for Platforms and Personnel

Technology Maturity

10-30 years

DISCOVER

Fundamental Research

Basic and Early Applied Research

Materials by Design

Conceptualized Quantum Memory

Technology Frame

Near

Experimental Prototyping & Improve Current Systems

- Drive Down Technical Risk
- Inform Achievable Requirements

High Energy Laser – Tactical Vehicle Demonstrator

Joint Multi-Role Technology Demonstrator

Aeromechanics and Computational Methods

Disruptive Energetics

Blast Protection for Platforms and Personnel

Technology Maturity

Fundamental Research

Basic and Early Applied Research

Materials by Design

Conceptualized Quantum Memory

Technology Frame

Near
Priority Investment Areas

• Army S&T Portfolio focus towards acceleration of priority technologies

• Priority technologies include:
  – Capability Enablers for 2026 and beyond
  – Decide Faster
  – Manned-Unmanned Teaming
  – Asymmetric Vision
  – Survive and Project Indirect Fires
  – Chief of Staff of the Army (CSA) Priorities

<table>
<thead>
<tr>
<th>CSA Priorities</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Armor</td>
<td>New Combat Vehicle</td>
</tr>
<tr>
<td>Future Vertical Lift</td>
<td>Aviation Protection</td>
</tr>
<tr>
<td>Infantry Support Tech.</td>
<td>Networks</td>
</tr>
<tr>
<td>Autonomy</td>
<td>Artificial Intelligence</td>
</tr>
<tr>
<td>Cyber/Electronic War.</td>
<td>Additive Manufacturing</td>
</tr>
<tr>
<td>Assured PNT</td>
<td>Robotics</td>
</tr>
<tr>
<td>Air &amp; Missile Defense</td>
<td></td>
</tr>
</tbody>
</table>
Army Investments by Portfolio

FY17: $2.4B*

As of PB17

Soldier/Squad
Personnel, Training, Human System Integration, Dismounted mission equipment and power & energy

Air
Advanced Air Vehicles; Unmanned Aerial Systems; Manned/Unmanned Teaming

Medical
Combat Casualty Care, Infectious Disease mitigation, clinical/rehabilitative medicine

Innovation Enablers
High Performance Computing; Environmental Protection; Base Protection; Studies; Technical Maturation Initiatives; Procurement

Lethality
Offensive/Defensive kinetic (guns, missiles), Soldier Weapons, Directed Energy (HEL) weapons

Ground Maneuver
Combat/tactical ground platforms/survivability; unmanned ground systems; austere entry; power & energy

Basic Research
Materials Science; Medical/Life Sciences; Quantum/Info Science; Autonomy; Networks

C3I
Secure Comms-on-the-Move; Cyber/EW; Sensors; Cyber; RF Hardware/Software Convergence; Assured PNT

Army Investments FY17
- BA1: $429M
- BA2: $908M
- BA3: $930M
- BA4: $70M
- BA6: $37M
- BA7: $62M

*Does not include $59M Procurement
Army S&T Enterprise—Research, Development & Engineering Centers (RDEC) & Labs

- 16 Army labs within 5 Army S&T Commands
- Approximately 13,000 Army Civilian Scientists and Engineers
  - 45% Bachelors Degree
  - 40% Masters Degree
  - 15% Doctorate Degree

- AMRDEC – Army Aeroflight Dynamics Directorate
- ARL – Aeroflight Dynamics
- Engineer Research and Development Center
  - Coastal and Hydraulics Lab
  - Environmental Lab
  - Geotechnical & Structures Lab
  - Info Tech Lab
- Aviation & Missile RDEC
- Space & Missile Defense Command Technical Center
- Research Institute of Environmental Medicine
- Natick Soldier RDEC
- Armament RDEC
- ERDC – Cold Regions Research & Engineering Lab
- Edgewood Chem Bio Center
- Research Institute of Chemical Defense
- ERDC Geospatial Research Laboratory
- ARL – Army Research Office
- ARL – Simulation & Training Technology Center
- Walter Reed Army Institute of Research
- Army Research Lab (ARL)
- ARL West
- ARL South
- Army Research Institute for the Behavioral & Social Sciences
- Communications-Electronics RDEC
- ECBC – West Desert Test Center – Life Science Division
- ERDC Construction Engineering Research Lab
- Institute of Surgical Research
- Army Research Institute of Infectious Disease
- ERDC – Engineering Research and Development Command
- Engineer Research and Development Center
- Chemical Defense
- Research Institute
- U.S. Army Materiel Command
- U.S. Army Medical Command
- U.S. Army Corps of Engineers
- U.S. Army Space and Missile Defense Command
- Headquarters, Department of the Army, G-1
Open Campus Initiative

Past: Current Defense Laboratory Model

Gates and high walls provide 20th century security, but are barriers to 21st century innovation

Defense laboratories relatively unchanged since inception (NRL 1923)

Present & Future: Open Campus Initiative

Reduction in barriers to facilitate collaboration with academia, industry, and small business

Less bureaucracy and paperwork

Open areas for researchers and access to existing facilities

Collaboration between ARL and external scientists

Career path for students and scientists

Hub and Spoke Model

Collaborator presence through EUL

An enhanced defense research environment that fosters discovery and innovation through collaboration on fundamental research

Novel staff opportunities
Developing a Hub and Spoke S&T Global Network

ARL Central
Advanced Photon Source
Old Main State College, PA

CRA - Cyber Security Research Alliance
Baltimore, Maryland

ISN
Cambridge, MA

CTA - Network Sciences
Washington, D.C.

CTA - Micro Autonomous Systems and Technology (MAST)
Alexandria, VA

CTA - Robotics
Falls Church, VA

CTA - Cognition & Neuroergonomics
Alexandria, VA

ARO Tokyo

Los Angeles, CA
ARL West

Electronic Materials
Salt Lake City, Utah

ICB - Santa Barbara, CA

ARL Primary Labs Site
ARL Field Element
Collaborative Alliances
Open Campus Hub
Collaboration Spoke
International Hub

ARL South
Austin, TX

ARL Central

ARL - Aberdeen Proving Ground

ARL - Adelphi Laboratory Center (Headquarters)

CRA - Materials in Extreme Dynamic Environments

CTA - Micro Autonomous Systems and Technology (MAST)

ARL - Orlando, FL

ARL South

ARL - Durham, NC

ARL London

AMR - Materials in Extreme Dynamic Environments
Baltimore, Maryland
Collaborative Mechanisms

- Cooperative Research and Development Agreements (CRADAs)
- Patent License Agreements
- Educational Partnerships
- Partnership Intermediary Agreements

Projects Being Negotiated

- Over 508 People Into and Out of Laboratory Under OC
- Active Collaborators: 96
- In-Process Collaborators: 80
- International Collaborators: 53 from 20 countries including China, India, Germany, Turkey, South Korea, Iran.

International CRADAs

- Three Active
- Six Pending

- **Australia** - University of Wollonong
- **Bulgaria & Ukraine** – Bulgaria Defense Institute, Chernihiv National University of Technology, National Technical University of Ukraine
- **Singapore** - Nanyang Technological University
- **Australia** - Australia National University
- **Australia** - University of Sydney
- **Budapest** - Budapest University of Technology and Economics
- **Israel** - Ben Gurion University
- **New Zealand** - University of Auckland
- **Norway** - University of Oslo
Open to national and DoD labs, universities, and industry

Multidisciplinary Focus:
- Manufacturing and processing
- Process-to-microstructure modeling
- Expeditionary technologies development
- Characterization based-performance using a probabilistic approach
- Rapid, in situ certification of additively manufactured parts

CURRENT PARTNERS:
- 3D Systems
- Orbital ATK
- Johns Hopkins (MEDE CA)
- ECBC
- UTEP

UNIQUE FACILITIES
- Selective laser sintering
- Hybrid additive manufacturing system
- Cold spray systems
- Materials characterization and computational tools
- Nondestructive Evaluation (NDE) Capabilities
- X-ray Computed Tomography suite
- Scanning and transmission electron microscopy
Army S&T Enterprise
U.S. Army University Funding

University Top Performers FY 2016

- University of Michigan - Ann Arbor: $10.9M
- University of California - Santa Barbara: $9.5M
- University of Southern California: $9.0M
- Massachusetts Institute of Technology (MIT): $7.3M
- University of Maryland - College Park: $6.8M
- Stanford University: $6.7M
- University of Pennsylvania: $5.9M
- University of California - Davis: $5.9M
- Pennsylvania State University: $5.6M
- California Institute of Technology: $4.8M

6.1 Research Funding by State
High Interest Basic Research Areas

- Human Agent Teams
- Artificial Intelligence & Machine Learning
- CEMA for Complex Environments
- Battlefield of Internet Things
- Biotechnology
- Tactical Unit Energy Independence
- Nanotechnology
- Manufacturing at Point of Need
- Human Performance Optimization
- Position Navigation and Timing in A2/AD
- Exploitation of Quantum Effects
- Advanced Energetics
- Neuro-Cognition
- Living Materials
- Beyond Novel Materials
Holistic strategy to enhance STEM capabilities: Broadening the STEM-literate talent pool; Attracting, recruiting and retaining elite STEM candidates; Outreach to diverse array of S&T organizations.
Summary

• Army refocusing investments to technologies enabling mid- and far-term capabilities

• S&T investments are critical for future Army operational capabilities

• Building strong working relationships with Academia is key for future workforce and technology development

• A strong STEM workforce and a STEM-literate public are critical to Army S&T
Army Science & Technology

Providing Soldiers Technology Enabled Capabilities

MAINTAINING A LEADING EDGE IN TECHNOLOGY