The Army Science & Technology Program

Jeffrey D. Singleton
Director for Technology
Office of the Deputy Assistant Secretary of the Army
Research and Technology

20 March 2018

Army Modernization Priorities

SECRETARY OF THE ARMY
WASHINGTON

29 SEP 2017

MEMORANDUM FOR THE DEPUTY UNDER SECRETARY OF THE ARMY

SUBJECT: Science and Technology Portfolio Realignment

1. The August 2017 senior leader review of the Fiscal Year 19-23 Program Objective Memorandum determined that the investment portfolio does not fully support the Army's new modernization priorities:

   a. Precision Fires

   b. Next Generation Combat Vehicle (NGCV)

   c. Future Vertical Lift (FVL)

   d. Network/Command, Control, Communications and Intelligence (C3I)

   e. Air and Missile Defense (AMD)

   f. Soldier Lethality

2. To maximize effectiveness for the Warfighter, the Army must immediately review the fiscal year 2018 (FY18) and FY19 investments to ensure the investments align with the new priorities—realigning what can be changed in the investment portfolio for FY18 budget and FY19 program to better support the six modernization priorities.

3. Roadmaps and metrics will be developed for the evaluation of the investment portfolio to allow for reallocating resources when a program does not deliver the needed outcome.

4. I expect the Army Staff and Secretariat, to include the organizations to whom a copy of this memorandum has been furnished, to support this important endeavor.

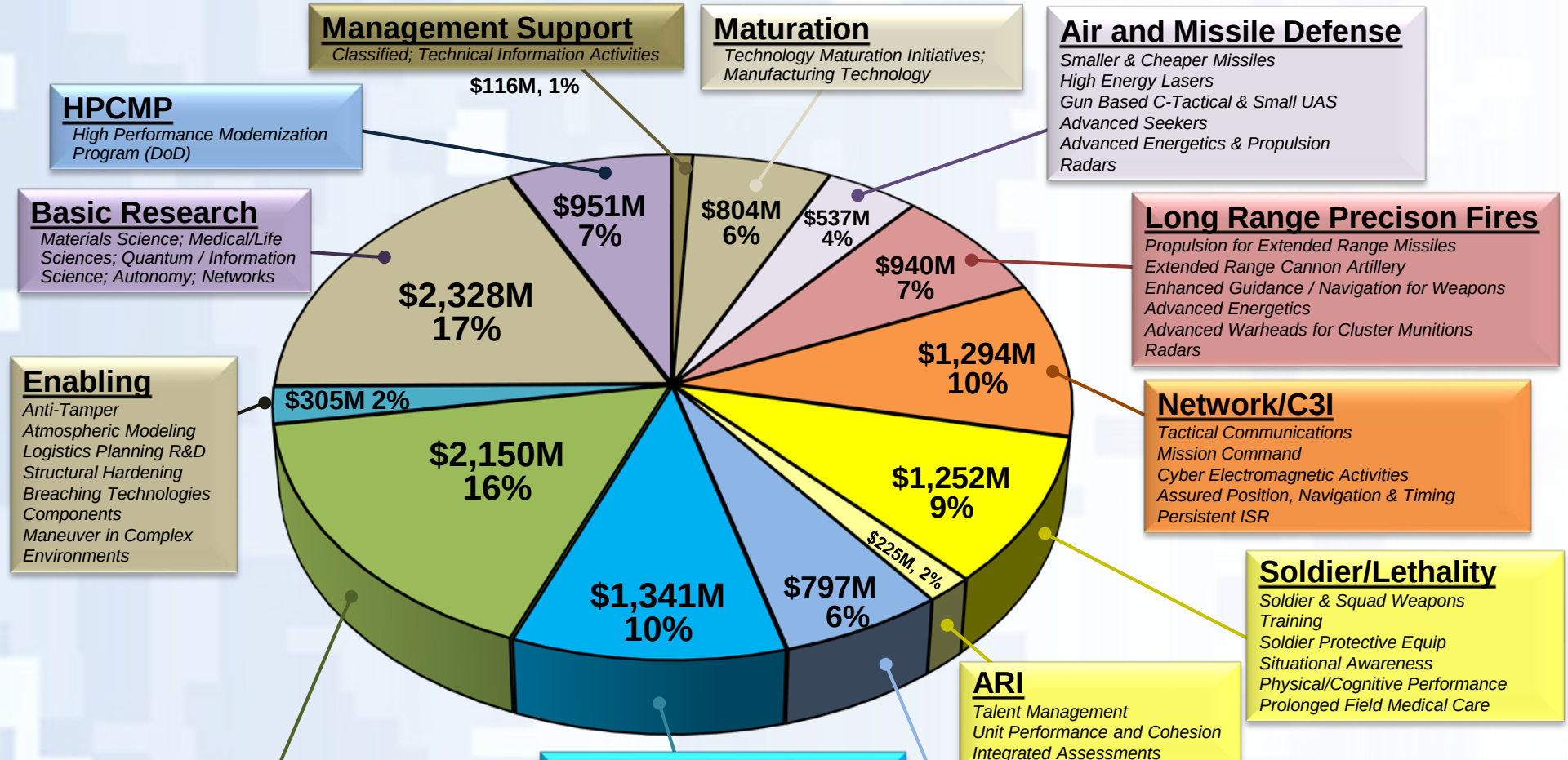
5. The Deputy Under Secretary of the Army will oversee these efforts and will provide bi-weekly updates to the Under Secretary of the Army and Vice Chief of Staff of the Army.

Ryan D. McCarthy
Acting

DISTRIBUTION:
(see next page)

Army S&T Investments by Priority

PB19 - $13.7B (FY19-23)



Management Support
Classified; Technical Information Activities

Maturation
Technology Maturation Initiatives; Manufacturing Technology

Air and Missile Defense
Smaller & Cheaper Missiles
High Energy Lasers
Gun Based C-Tactical & Small UAS
Advanced Seekers
Advanced Energetics & Propulsion
Radars

HPCMP
High Performance Modernization Program (DoD)

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

Long Range Precison Fires
Propulsion for Extended Range Missiles
Extended Range Cannon Artillery
Enhanced Guidance / Navigation for Weapons
Advanced Energetics
Advanced Warheads for Cluster Munitions
Radars

Enabling
Anti-Tamper
Atmospheric Modeling
Logistics Planning R&D
Structural Hardening
Breaching Technologies
Components
Maneuver in Complex Environments

Network/C3I
Tactical Communications
Mission Command
Cyber Electromagnetic Activities
Assured Position, Navigation & Timing
Persistent ISR

Soldier/Lethality
Soldier & Squad Weapons Training
Soldier Protective Equip
Situational Awareness
Physical/Cognitive Performance
Prolonged Field Medical Care

ARI
Talent Management
Unit Performance and Cohesion
Integrated Assessments

Next Generation Combat Vehicle
Next Gen Combat Vehicles Design
Vehicle Protection Against Advanced Threats
Advanced Power Generation and Distribution
AI, Robotics and Autonomy for Logistics & Combat Ops
Advanced Energetics & Direct Fire Weapons Systems

Future Vertical Lift
Platform Development and Demonstration
Next Generation Unmanned Aircraft System Technologies
Aviation Protection / Aircraft Survivability
Situational Awareness
Integrated Mission Systems
Advanced Power Systems

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

Army Investments	FY19-23
BA1	$2,328M
BA2	$4,767M
BA3	$5,290M
BA4	$522M
BA7	$301M

BA6 $155M, Procurement $350M

Version: 26 Jan 2018

Long Range Precision Fires

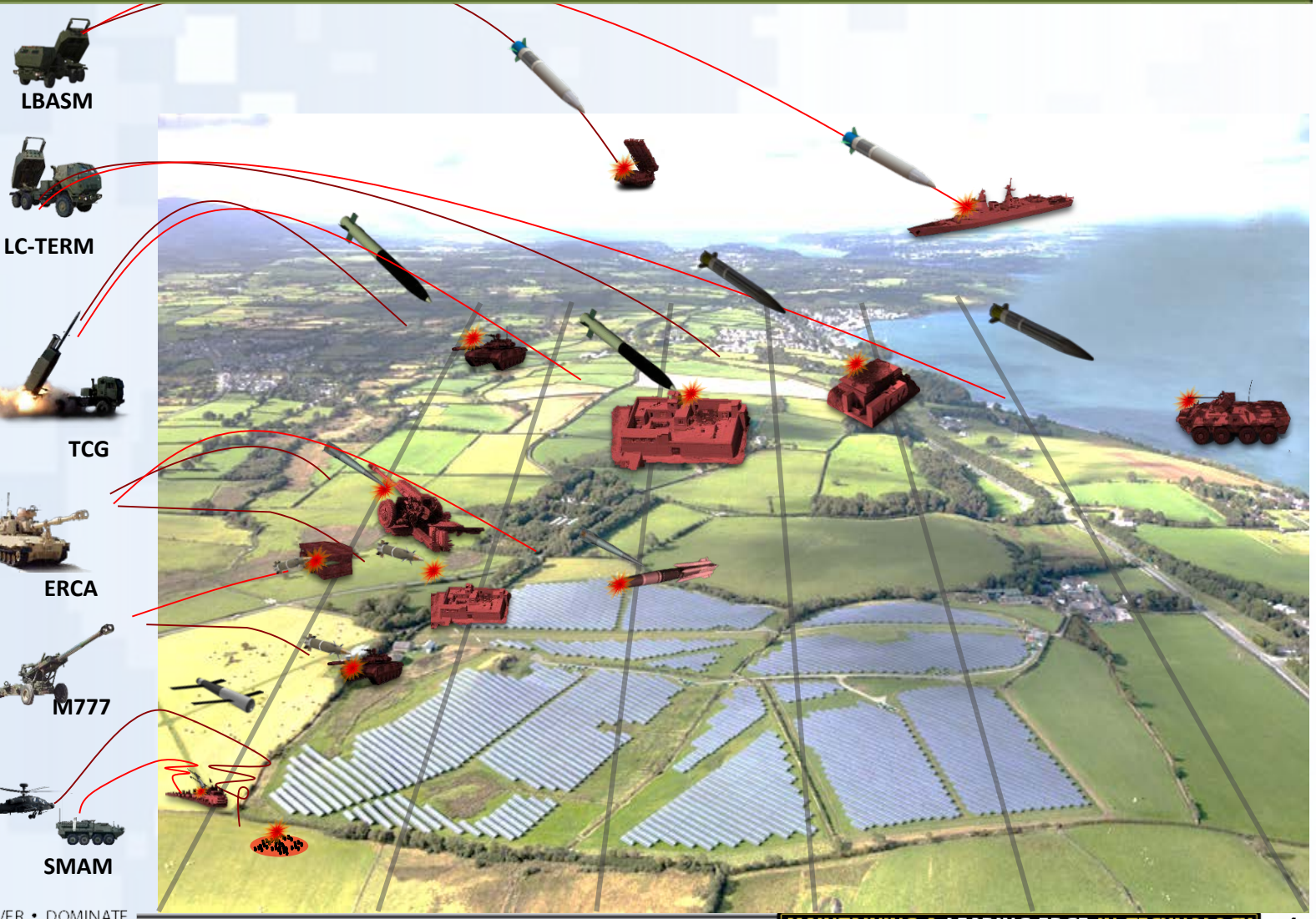
Goal: Provide extended range allowing an increased capability to support maneuver and counter enemy long-range systems.

Technology Demonstrations

- Land-Based Anti- Ship Missile (LBASM)
- Single Multi-mission Attack Missile (SMAM)
- Multiple Simultaneous Engagement Technologies (MSET)
- Extended Range Cannon Artillery (ERCA)
- Low Cost – Tactical Extended Range Missile
- Cluster Munition Replacement Technologies
- Long Range Maneuverable Fires (LRMF)

Critical Technology Areas

- Extend Range
- Expand Coverage
- Enable Cross-domain Maneuver



Land-Based Anti-Ship Missile (LBASM)

Payoff:

- Cross-domain Fires: enables Multi-Domain Battle through the projection of power from land into the maritime domain
- Tier One CNA16 Capability Gap 501343 (High Risk): capability to engage, & defeat surface targets located in littoral waters up to 499km range
- Tier One CNA16 Capability Gap 550083 (Extremely High Risk): capability to destroy enemy air defenses

Purpose:

- Adapt Army and Marine Corps HIMARS and MLRS rocket and artillery systems to provide a Defeat of Enemy Air Defense (DEAD) capability against land- and maritime-based targets

Products:

- Development and demonstration of appropriate sensor, datalink, and payload component technologies for engaging and defeating land- and maritime-based ADA
- Integration of these component technologies into prototype missile hardware and demonstration of this hardware in a relevant flight environment
- Provides evidence for the feasibility of adapting existing Army and Marine Corps GMLRS and HIMARS systems for offensive anti-ship warfare
- Provides a basis for cost-capability trades for an objective system

Next Generation Combat Vehicle

Goal: Provide an experimental Prototype in FY 20 for Soldier evaluation.

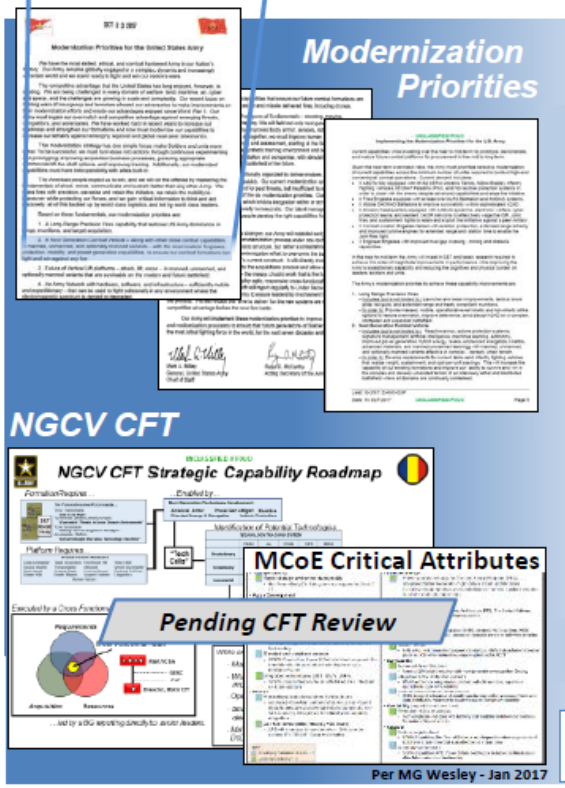
Technology Demonstrations

- Combat Vehicle Robotics (CoVeR)
- Robotics for Engineer Operations
- Ground System Active Defense (GSAD)
- Advanced Powertrain Demonstrator
- Advanced Lethality & Accuracy System for Medium Caliber (ALAS-MC)
- Extended Line of Sight (ELoS)

Critical Technology Areas

- Maneuver Robotics and Autonomous Systems
- Directed Energy & Energetics
- Power Generation & Management
- Advanced Armor
- Vehicle Protection Suites

*"A Next Generation Combat Vehicle - along with other close combat capabilities in **manned, unmanned, and optionally-manned** variants - with the most **modern firepower, protection, mobility, and power generation capabilities**, to ensure our combat formations can fight and win against any foe."*



FOR NEXT GENERATION CAPABILITIES...

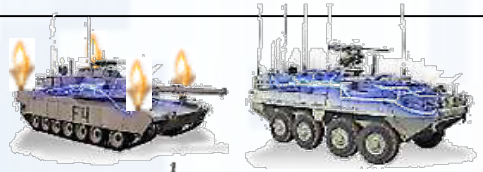
- SMART
- FAST
- LETHAL
- PRECISE
- PROTECTED
- ADAPTABLE

Critical Attributes drive NGCV Concepts & Virtual Prototyping Informs Operational Requirements

Ground System Active Defense

Multi-Threat Domain and Changing Operational Environment

Active Blast Defeat



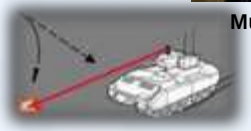
Active Physical & Electronic Defeat

Top Protection

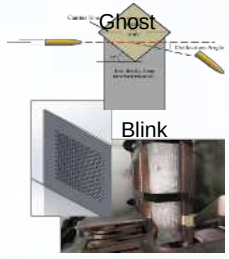
Hard-Kill

Active Interior Technology

Multi-Spectral Laser Protection



Soft-Kill



Adaptive Armor

Active Survivability Subsystems and Effectors

Develop active survivability subsystems and effectors which sense, track and respond to neutralize threat prior to terminal effects. System leverages common architecture to provide threat defeat redundancy and layered survivability to optimize protection with reduced weights.

Pre-shot Detection/ Revenge Kill

Active Physical, Electronic Defeat; Mechanical Ctr Measures; Adaptive Interior Protection, Adaptive Armor

Future Vertical Lift

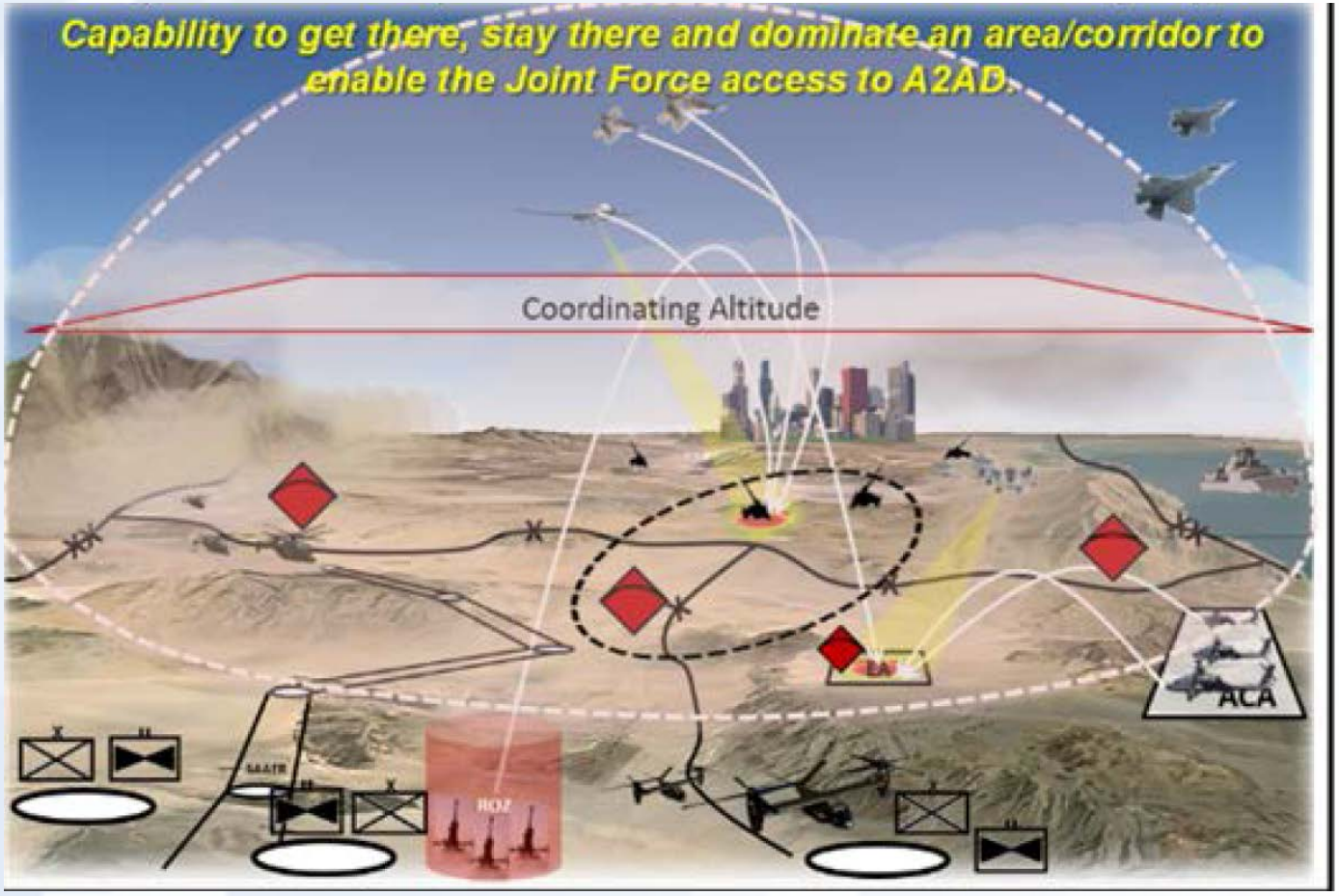
Goal: Close selected Army capability gaps and rapidly deliver 5th Gen rotorcraft to the Army.

Technology Demonstrations

- Joint Multi-Role Technology Demonstrator
- Degraded Visual Environment-Mitigation
- Next Generation Tactical UAS Tech Demonstrator
- Alternative Concept Engine
- Next Gen Rotorcraft Transmission
- Integrated Mission Equipment
- Modular Missile Technology
- Multi-Role Small Guided Missile
- Advanced Rotorcraft Armaments Protection System

Critical Technology Areas

- Expanded Reach & Protection during Movement of Forces
- Increased payload, maneuverability and performance
- Manned-Unmanned Teaming



Next Generation Tactical UAS

Purpose:

- Develop and demonstrate transformational air vehicle technologies that overcome key barriers to enable the Future Tactical UAS performance, survivability, and reliability requirements and operational capabilities

Products:

- Informed Requirements for FTUAS, including new concepts of operations
- Wingman concepts for FVL manned systems
- Enhanced survivability enabling operations in highly contested environments
- System-level SWAP allocation
- Informed Model Performance Specifications (MPS) used as basis for solicitation of FTUAS aircraft; provides quantifiable metrics for technical evaluation of proposals

Payoff:

- A refined set of technologically feasible and affordable capabilities that enable Future UAS requirements in POR EMD phase
- Operational parity with manned fleet enabling advanced manned unmanned teaming (MUM-T)
- Government-owned decision support tools and data readily available to support future acquisitions and product upgrades

Network/C3I

Goal: Provide Soldier with assured communications in contested environments through situationally-aware, intelligent network, and autonomously routing of information over resilient communications link.

Technology Demonstrations

- Modular RF
- Non-Traditional Waveforms
- Protected SATCOM
- WGS Interference Cancellation
- Spectrum Obfuscation
- Next Gen HF
- Every Receiver a Sensor
- Robust Grey C3I
- Integrated Demos with NGCV, Soldier Lethality, FVL, AMD, and LRPF

Critical Technology Areas

- Tactical Network/Comms
- CEMA/EW/Cyber
- Mission Command/Command Posts
- A-PNT
- Persistent ISR

Modular RF Communications

Purpose:

- Enable connectivity in contested and congested environments by applying modular radio frequency (RF) and networking techniques, to adapt and continue operation under interference signals

Products:

- A system architecture for modular RF networks to be integrated with a single user device
- Autonomous networking to provide agile detection and switching amongst available network connections to maintain network resiliency in congested and contested environments
- Soldier Radio Waveform (SRW) on a modular module to integrate within an automated network
- Distributed, dismounted beamforming for communications through RF interference
- Low Probability of Interception and Detection (LPI/LPD) techniques that support communications in contested and congested environments

Payoff:

- The ability to operate in congested, and contested environments, and automatically adapt and respond to dynamically changing situations without user input
- Elimination of single point of failure when operating as a mobile protected network with assured and resilient communications at the tactical edge
- Common user interface with seamless incorporation of new and additional network capabilities through open architecture design

Air and Missile Defense

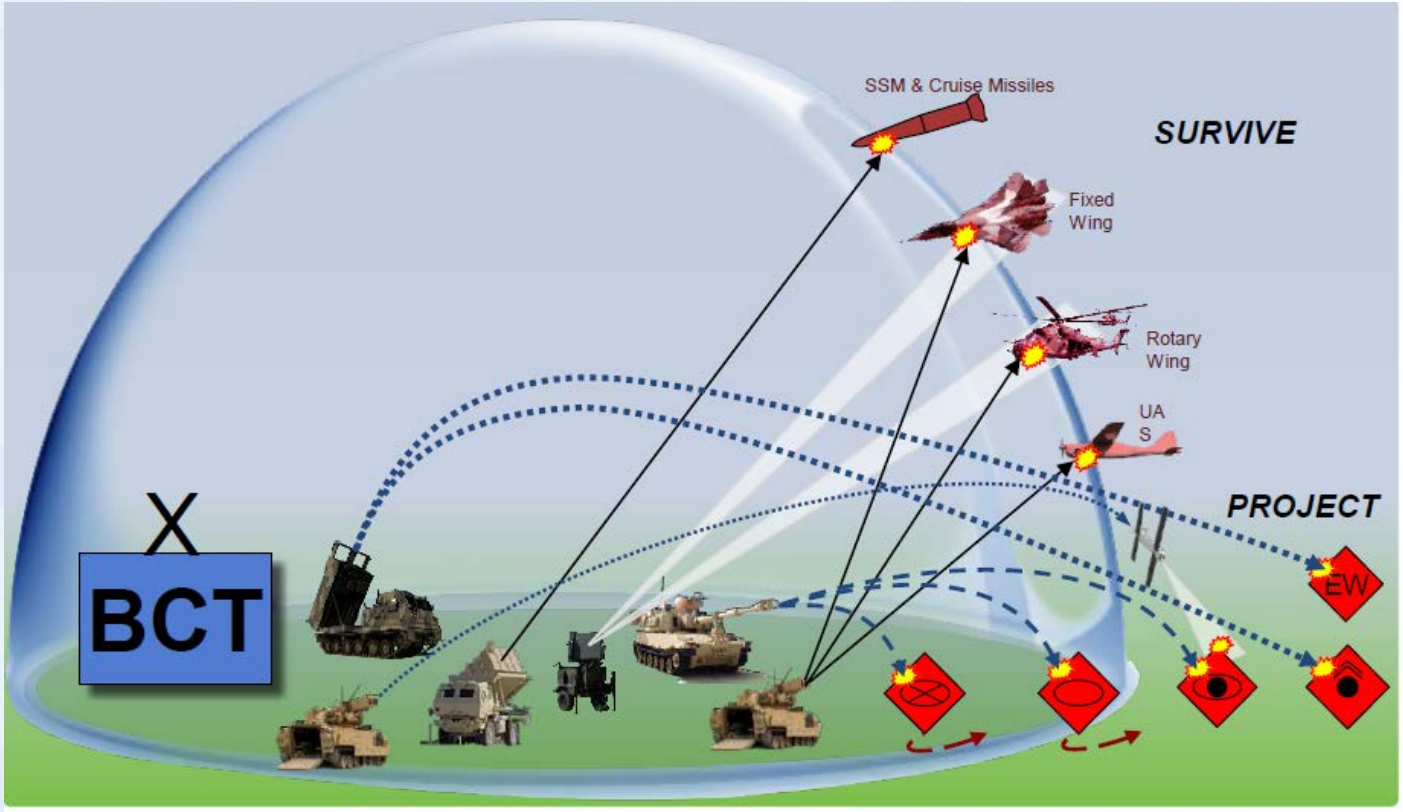
Goal: Provide capability to defend against enemy air attack at extended range.

Technology Demonstrations

- Low Cost Extended Range Air Defense (LowER AD)
- Maneuver AD Technologies (MADT)
- Ballistic Low Altitude Drone Engagement (BLADE)
- Accurate Rapid Controlled Hybrid Effects Round (ARCHER)
- High Energy Laser Tactical Vehicle Demonstrator (HEL TVD)
- Multi-Mission High Energy Laser (MMHEL)
- Unconventional Countermeasures & Survivability

Critical Technology Areas

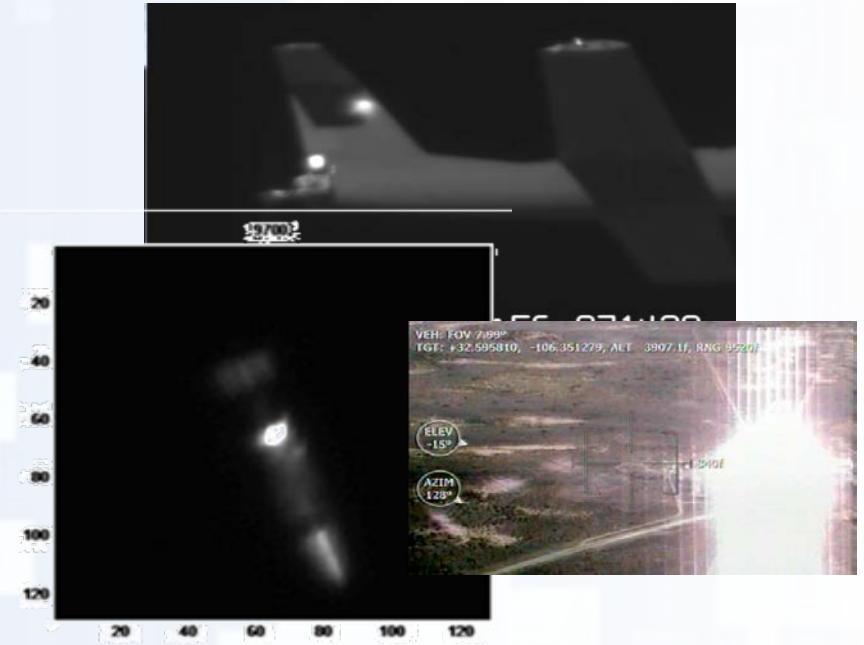
- Mobile and Survivable Maneuver Short Range Air Defense (M-SHORAD)
- Counter UAS
- Operate within a Contested Environment



Technology Maturation Initiative: Multi-Mission High Energy Laser (MMHEL)

Purpose: Integrate and demonstrate a High Energy Laser (HEL) weapon system that can maneuver with operational forces to counter rocket, artillery and mortar (RAM), Unmanned Aerial Systems (UAS), intelligence, surveillance and reconnaissance (ISR), rotary and fixed wing Maneuver Short Range Air Defense (M-SHORAD) threats.

Multi-Mission High Energy Laser Platform



Successful 10kW HEL Demonstrations: Defeated UAS and Light Mortar in Flight

Products:

- 50kW-class Risk Reduction Demo on High Energy Laser Mobile Test Truck (FY18)
- TRL 7 MMHEL 50kW-class system demonstration (FY21)

This effort leverages Army S&T investments in the High Energy Laser Tactical Vehicle Demonstrator (HEL TVD) effort as well as High Energy Laser Joint Technology Office investments in solid state laser development and advanced beam control systems.

Soldier Lethality

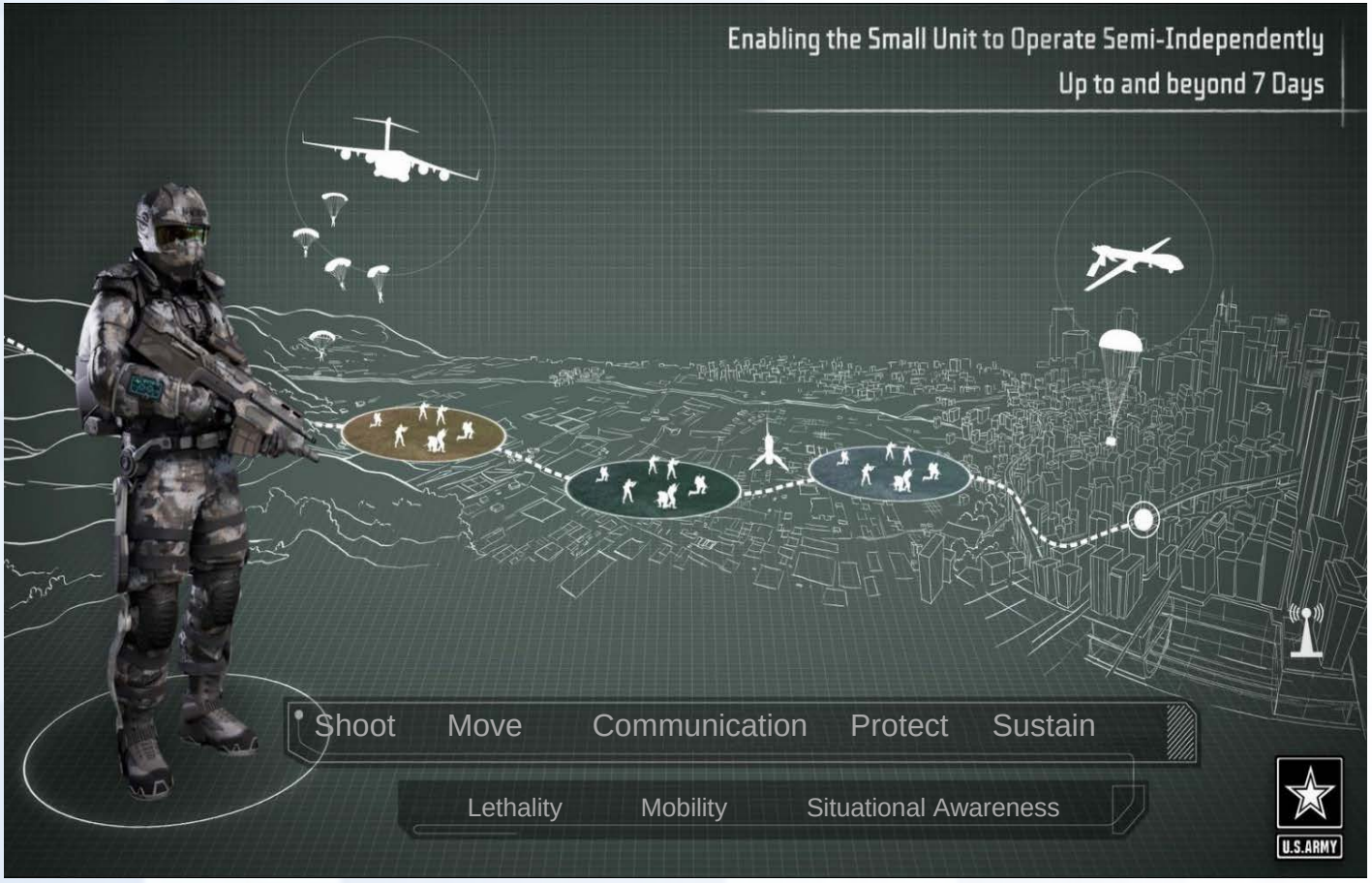
Goal: Improve Soldier and small unit performance, reduce surprise, increase protection, and enhance lethality in close combat on an intensely lethal and distributed battlefield and within complex, urban terrains.

Technology Demonstrations

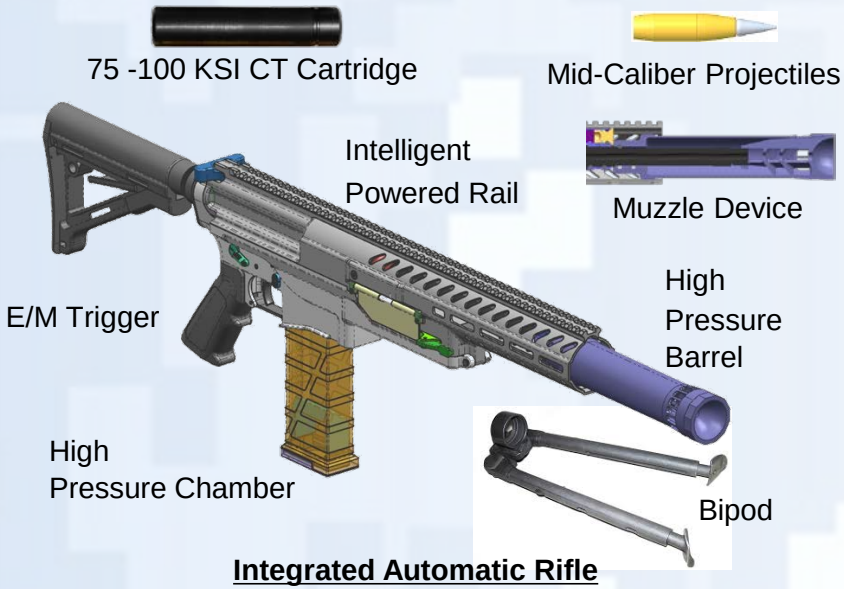
- Next Gen Squad Weapons Technology
- Next Generation Family of Ammunition
- Soldier Signature Management
- Extreme Austere Environmental Protection
- Integrated Headborne Systems
- Body Armor
- Common Synthetic Environment
- Exoskeleton Systems

Critical Technology Areas

- Next Generation Squad Weapons and Ammunition
- Enhanced Body Armor
- Improved Soldier and Small Unit Performance
- Reduce the Soldier's Load and Increase Bearing Capacity



Next Generation Squad Weapons Technology



Integrated Automatic Rifle

Purpose:

- Provide critical weapon integrated technologies for Next Generation Squad Automatic Rifle (NGSAR – M249 replacement), leveraging LSAT, FAST, 6.5mm CT Carbine, and SAAC study results
- Develop weapon technologies to enable higher pressures
- Provide for fire control integration (SCOPE program)

Product:

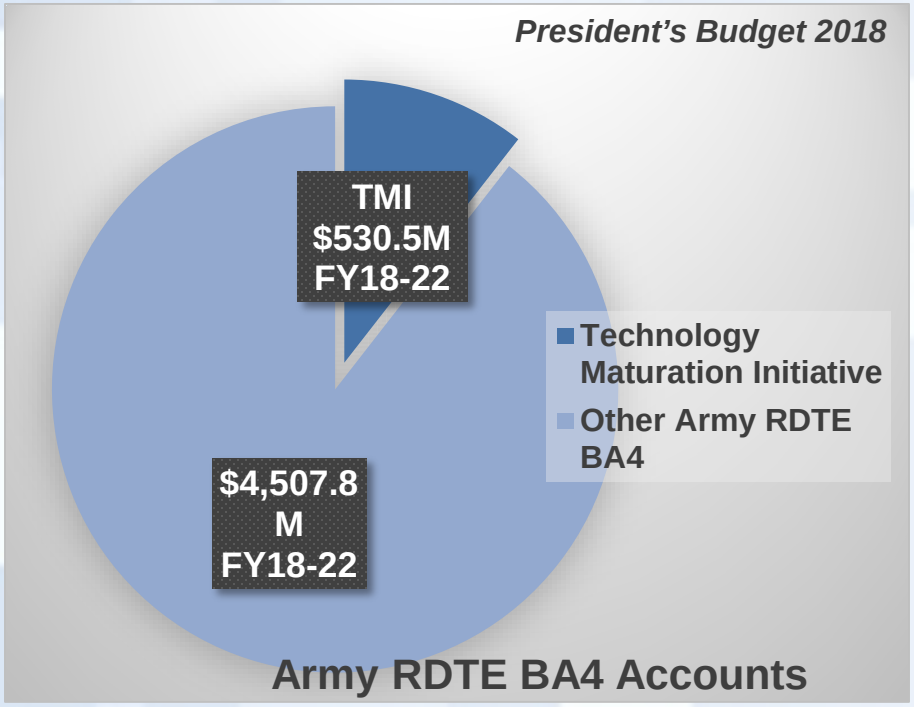
- Demonstration of Weapon/Cartridge for Automatic Rifle (TRL 6)
- Optimized Cartridge Configuration – weight/size vs. lethality
- 75-100 KSI Case Telescoped (CT) Cartridge
- Mid-Caliber (6.8mm) Projectiles (TRL 5/6)
- High Pressure Chamber lightweight materials
- High Pressure Barrel lightweight materials and processes
- Muzzle Device – recoil and signature reduction
- Integrated E/M Trigger and Intelligent Rail - interfaces for SCOPE
- TDP for weapon, ammunition, and fire control interface

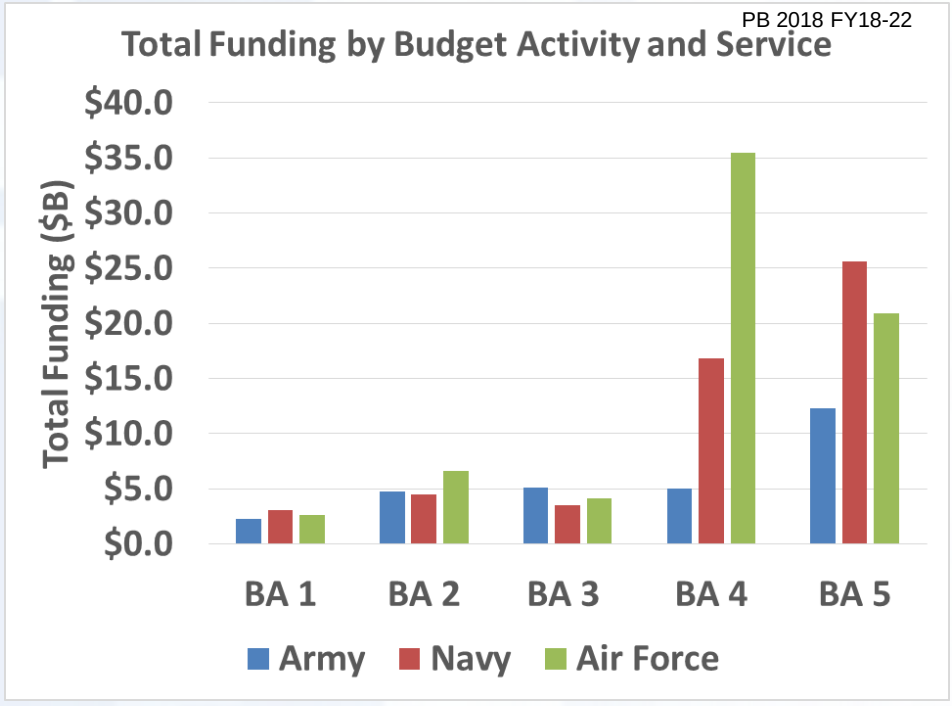
Payoff:

- Meets critical threshold values for Next Gen Squad Automatic Rifle (NGSAR) CDD and entrance criteria for MS-B, transition to PEO Soldier/PM Soldier Weapons
- Provides a TRL 6 platform and growth for NGSAR and future squad weapons by providing the next generation cartridge (carbine, SDMR, etc.)

Army BA 4 Technology Maturation Initiative

- **Experimental and Early Developmental prototyping to inform emerging Army requirements and/or prepare S&T products for integration into future systems**
- **Only Army BA 4 investment not tied to a Program of Record (PoR)**
  - **Experimental Prototyping for future Army capabilities for which there is no PoR**
  - **Early developmental prototyping in partnership with Acquisition to inform and provide basis for emerging and objective requirements**
- **TMI oversight by 2-star Technology Maturation Executive Steering Group**





Army Educational Outreach Program (AEOP)
-part of a holistic strategy to address workforce needs

Vision: A diverse, agile, highly competent STEM talent pool, representative of our nation's demographics to supply Army workforce initiatives

Mission: Offer students and teachers a collaborative, cohesive, portfolio of Army-sponsored STEM programs that effectively engage, inspire, and attract the next generation of STEM talent through K-through college programs and expose them to DoD STEM careers

Priorities:

- STEM Literate Citizenry: broaden, deepen, and diversify the pool of STEM talent in support of our Defense Industrial Base (DIB)
- STEM Savvy Educators: support and empower educators with unique Army Research and Technology resources
- Develop and implement a cohesive, coordinated, and sustainable STEM education outreach centralized infrastructure across the Army

The Army has a holistic approach to STEM capabilities

AEOP serves to broaden the future talent pool

AEOP Impacts
-FY17 unless otherwise noted

32,947 Students
2,307 Teachers

485 Universities or Colleges
92 HBCU's or MSI's
3,467 K-12 schools

83% Alumni reported that AEOP mentors helped influence academic career decisions

FY17 included evaluation of AEOP on 21st century workforce skills

15 Strategic Partner Organizations Serving Underserved Youth

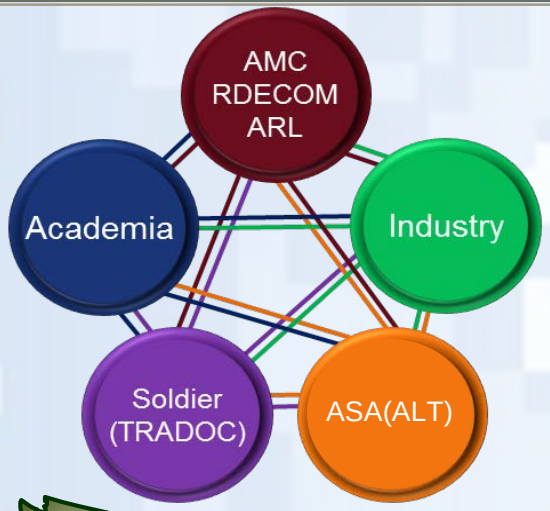
42% of the apprentices in FY17 included students from underserved populations

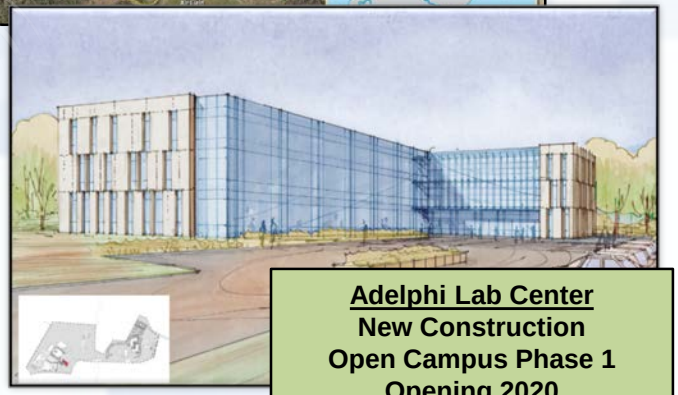
FY17 AEOP Alumni Leadership Counsel Developed

95% FY16 Alumni stated AEOP contributed to growth in STEM knowledge

Comprehensive program evaluations and assessments can be found at www.usaeop.com/impacts

Open Campus





Adelphi Lab Center
New Construction
Open Campus Phase 1
Opening 2020

Collaborations focused on Army-specific challenges of mutual importance to all partners

Partners from Army, Industry and Academia engage in research with shared access to people, infrastructure and resources

"…a role model to the broader defense research enterprise"

- Defense Science Board (DSB) Task Force on Defense Research Enterprise Assessment, January 2017

Summary

- Army Science and Technology works to Enhance Current Systems and Enable Future Systems
- In PB 2019 Army S&T resources are aligned to support the Army's Modernization Priorities
- Open Campus is continuing to expand opportunities for collaboration

Questions?