Army Science & Technology

12th Annual Science & Engineering Technology Conference / DoD Tech Exposition

Providing Technology Enabled Capabilities

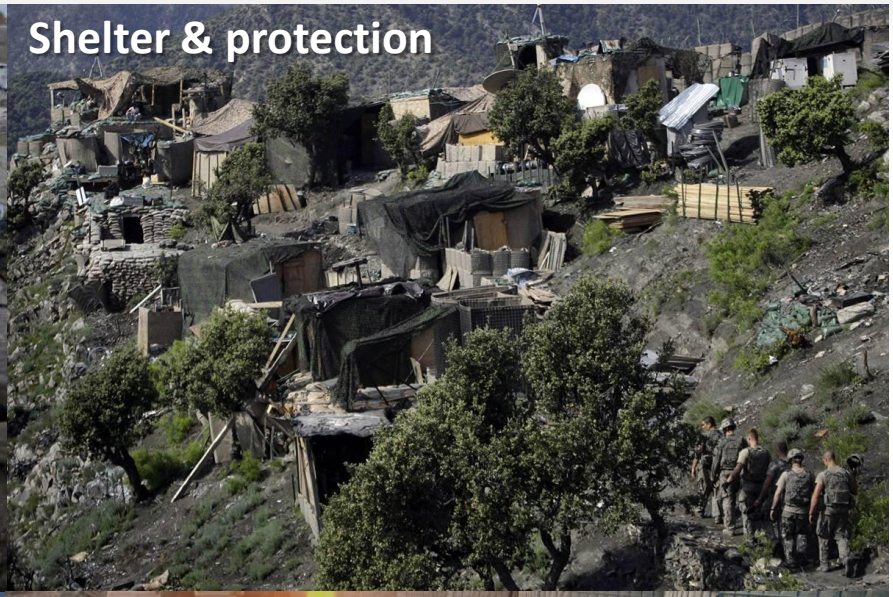
Dr. Marilyn M. Freeman
Deputy Assistant Secretary of the Army
for Research and Technology

June 22, 2011

We have been at War for 10 Years…

What have we Learned?

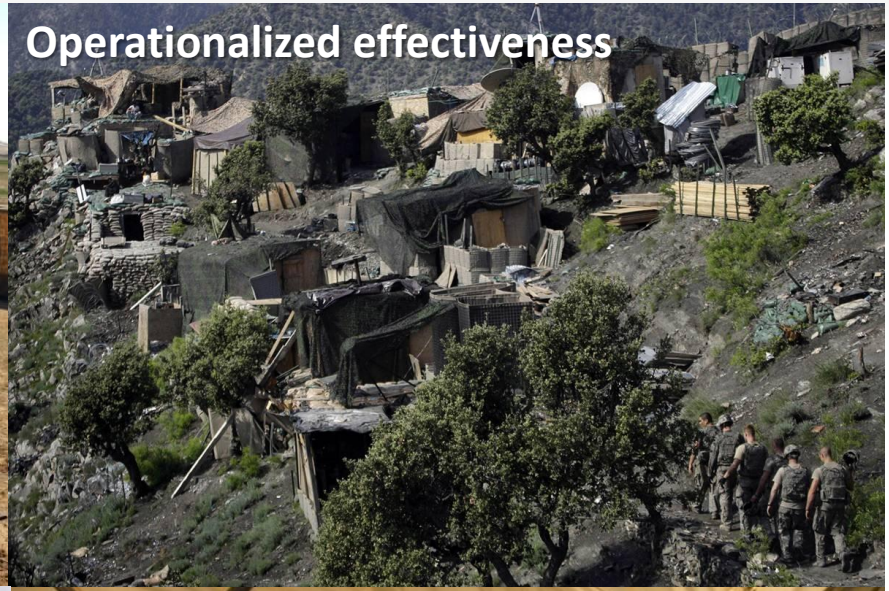
It's all about the Soldier – Basic Human Needs



It's all about the Soldier –
Expeditionary Maneuver / Tactical Force Projection

It's all about the Soldier – Force Protection

It's all about the Soldier – Expeditionary Basing



It's all about the Soldier – Cognitive, Physical & Social Performance







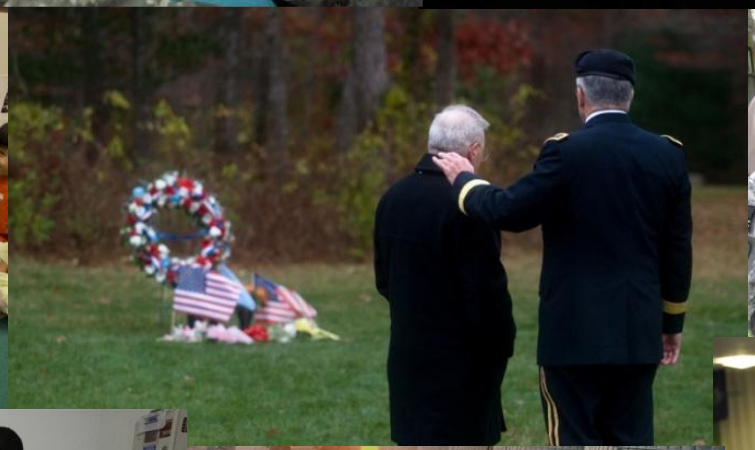


It's all about the Soldier – Spiritual, Cultural, Social Needs

It's all about the Soldier – Cultural, Spiritual & Social Connectedness

It's all about the Soldier





This is What We Learned – It's all about the Soldier and …

"In the past the small unit was built around the fighting system. Today and for the future, the fighting system must be built around the small combat unit."

— MG(R) Robert Scales*

*Ground Combat Vehicle CONOPS - Concept paper dated Dec 2, 2010

Army S&T Raison d'Être

Foster invention, innovation, maturation, and demonstration of technologies to enable Future Force capabilities while exploiting opportunities to transition technology enabled capabilities to the Current Force

Current Force

Modular Protective Systems

IED/Mine Detection Ground Penetrating Radar

Unattended Transient Acoustic MASINT System

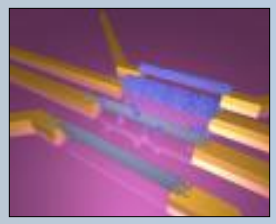
MRAP Expedient Armor Program

Enabling the Future Force

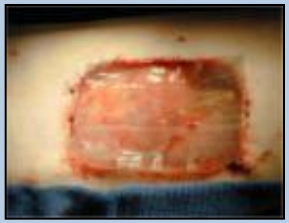
Enhancing the Current Force

Future Force

Immersive Training



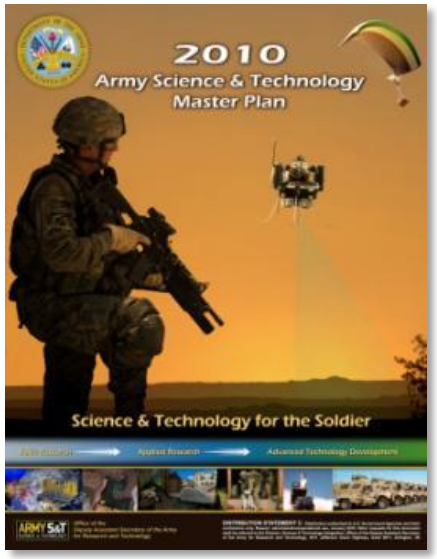
Virus-based Self-Assembling Electrodes



Regenerative Medicine

Autonomous Materiel Handling System

DASA (R&T) Responsibilities



- Advise Army Leadership and the Acquisition Community on scientific and technical matters
- Maintain balanced S&T portfolio responsive to Warfighter needs—advocate and defend Army S&T investments
- Provide policy and guidance to the S&T Enterprise
- Promote technological innovation throughout the acquisition process
- Laboratory Management—improve/maintain health of Army labs/centers
- Assess technology readiness and facilitate transition to systems

Principal Proponent and Accountable Senior Official for Army Science, Technology and Engineering

The Army S&T Workforce

Total Civilian Manpower: 18,640

- 10,949 Scientists & Engineers
- 1,443 S&E's are supervisors
- Approximately 9% new hires in FY10

Level of Education

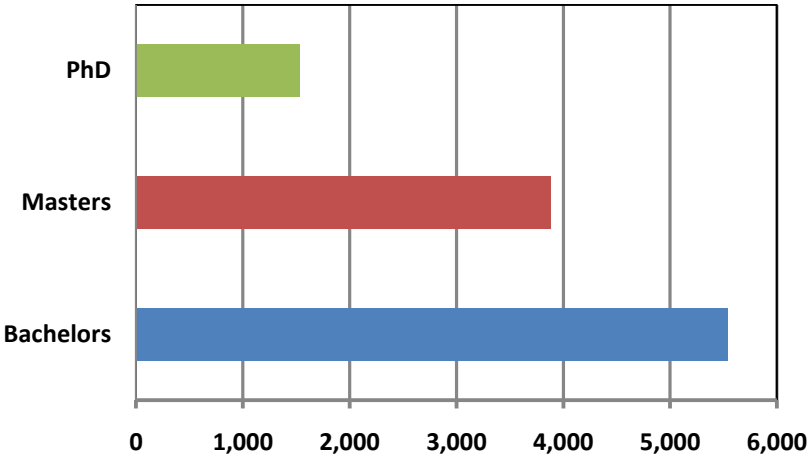
- 37% of new hires from Tier 1 schools
- 35% of S&E have MS
- 14% of S&E are PhD

Expertise Across Lifecycle

- **Deployable Employees:**
  - field-deployable scientists, engineers, technicians and operators
- **Matrixed support to JPEO/PEO offices**
- **Military personnel**

Critical and Unique Research Competencies and Facilities:

- Sensors, Electronics, and Materials
- Human Performance and Behavioral Science
- Clothing and combat feeding
- Medicine and clinical research
- Infectious diseases and battlefield medicine
- Munitions and warheads
- Threat agent chemistry and biochemistry
- Biology and environmental sciences
- Geospatial
- Sensor technology for space applications
- Network, cybersecurity, and information fusion



Degrees Held by Civilian S&E Workforce

DASA(R&T)'s Problem & Challenge

- **The Problem**
  - **It takes too long to get technology enabled capabilities to the field**
  - **Army S&T is perceived as irrelevant**

- **Fixing the Problem requires:**
  - **New comprehensive strategy**
  - **Changing the culture**
  - **Restoring confidence in Army S&T**
  - **Building a strong Partnership with Leadership**
  - **Motivating the workforce towards results**

We have been working on this for a year – and we are on the path to fixing it!

Strategy for Change
Value Proposition for Army S&T

Vision
Provide technology enabling capabilities that Empower, Unburden and Protect our Soldiers and Warfighters in an environment of Persistent Conflict

Strategic Perspective for Success
Timely delivery of capabilities fostered by effective partnerships in synchronization with Army Force Generation and fiscal processes in accordance with the priorities of the Chief of Staff and Secretary

Respond Rapidly to Technological Evolution

New Metrics for Value of Army S&T:

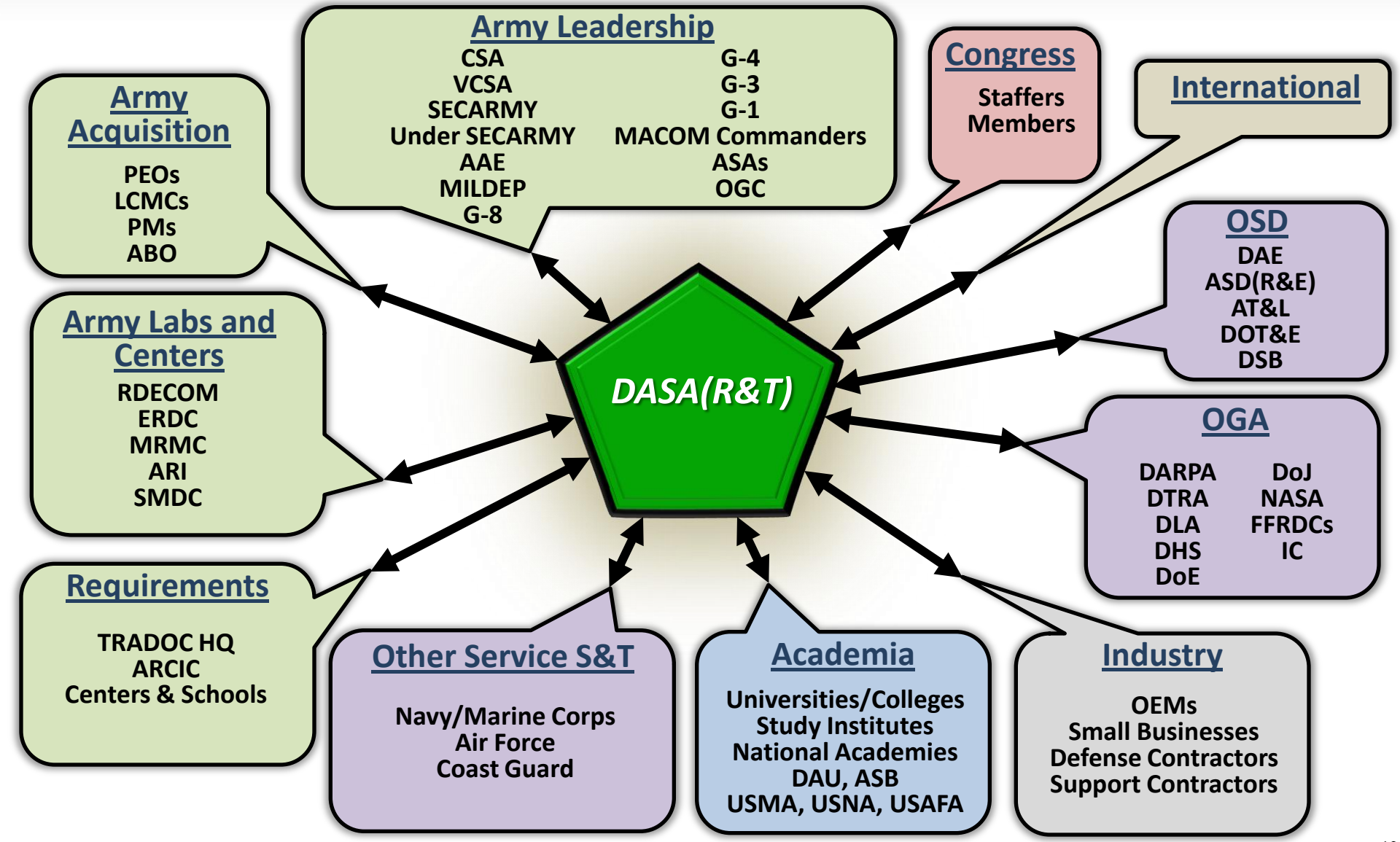
- The technical capabilities we provide to Warfighters
- The data and information we provide to decision makers
- The quality of the research, development, and engineering conducted in our laboratories and centers
- The contributions of our subject matter experts who participate in decision making activities
- The number of times we are called upon to provide innovative solutions to big Army/ DoD problems
- Our ability to effect positive change

New Strategic Goals for Army S&T

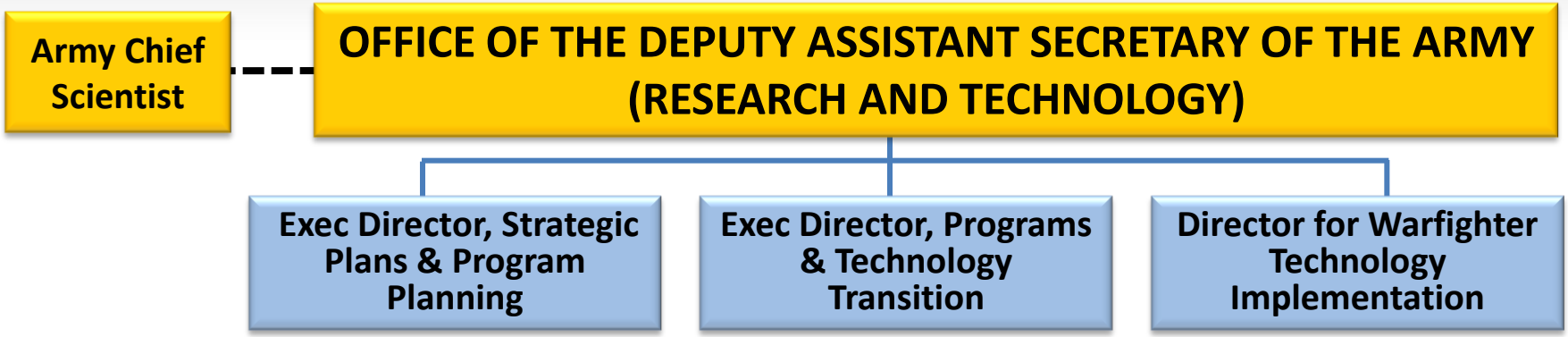
- "World Class" Science & Technology
- Timely Transition of the Right Technologies
- Recognized Leader in Defense Development and Engineering
- Strong Internal & External Partnerships
- High Quality, Relevant Facilities and Capabilities
- A Balanced Investment Portfolio
- Highly Skilled, Motivated Workforce that Exemplifies our Core Values
- Effective, Efficient, & Adaptable Processes
- Government and Public Understanding of Our Value

Overarching Goal: To be the Army Senior Leadership's "Go-To" place for all Science & Technology and Engineering issues

Building Partnerships Across the Enterprise



DASA(R&T) – The New Organization



Portfolios

- Director for Soldier Systems S&T
- Director for Ground Systems S&T
- Director for Air Systems S&T
- Director for C^3 Systems S&T

- Director for Basic Research

Functions

- Director for Lab Management & Educational Outreach
- Director for Business & Operations
- Director for Studies, Analyses & Assessment

Army S&T Alignment—Soldier Systems
6.2 and 6.3 FY12

1. Data to Decisions
2. Engineered Resilient Solutions
3. Cyber Science & Technology
4. Electronic Warfare/Electronic Protection
5. Counter Weapons of Mass Destruction
6. Autonomy
7. Human Systems

Human Dimension:
- Soldier Leader Training
- Equipment designs which reduce physical and cognitive burden during training, operations and reset
- Cultural Awareness

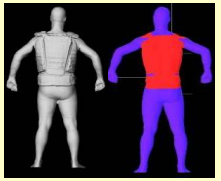
Soldier Load & Protection:

- Offloading technologies
- Lightweight, threat tailored, ballistic and blast components for Soldier mobility & survivability
- High density and efficient energy sources
- Decision aides for mission equipment planning
- Lethality assets that are lighter & environmental friendly
- Low-cognitive user interface technologies

Mission Command:
- Dismounted Mission Command Technologies
- NSA approved wireless protocol & novel Soldier personal area network architectures
- Technologies with allow freedom of maneuver across battlespace
- Distributed information & situational awareness

Health Promotion:
- PTSD and TBI treatments
- Suicide Prevention Study
- Psychological Resetting After Combat Deployment
- Nutrition Sustainment
- Fatigue Interventions

Combat Casualty Care:
- Regeneration of Damaged Tissue
- Ocular and Maxillofacial Trauma
- Musculoskeletal Injury
- Regenerative Medicine to Reduce and Repair Burn Injury
- Blood Products Research
- Wound Infection Countermeasures



Army S&T Alignment—Ground Systems
6.2 and 6.3 FY12

1. Data to Decisions
2. Engineered Resilient Solutions
3. Cyber Science & Technology
4. Electronic Warfare/Electronic Protection
5. Counter Weapons of Mass Destruction
6. Autonomy
7. Human Systems

Ground Vehicle Power and Mobility:

- High temperature power electronics
- Fuel cell for silent watch
- Prime Propulsion

Survivability:

- Occupant Centric protection systems
- Light-weight, multi-hit and multi-functional integrated armors
- More effective and compact KE defeat APS

Intelligent Ground Systems:

- Fully autonomous leader/followers
- Tactical formation
- Human Machine Interface

Unmanned Ground:

- Virtual testing of UMS
- Autonomous mobility performance in complex environments
- Soldier/robot and robot/robot teaming
- Autonomous Robotics Systems
- Indirect Vision Technologies
- Unmanned Systems Technology Development
- 360°Situational Awareness Technologies
- Soldier Machine Interfaces

Deployable Force Protection:

- Integrated, lightweight protection technologies for small bases (<300 people)
- Line-of-sight and non-line-of-sight detection
- Organic active and passive defense
- Robust and resilient systems

Army S&T Alignment—Air Systems
6.2 and 6.3 FY12

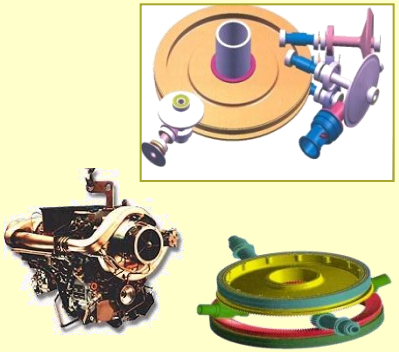
1. Data to Decisions
2. Engineered Resilient Solutions
3. Cyber Science & Technology
4. Electronic Warfare/Electronic Protection
5. Counter Weapons of Mass Destruction
6. Autonomy
7. Human Systems

Platform Technologies:

- Joint Multi-Role Technology Demonstrators
- Rotorcraft Airframe Technology
- Platform Durability & Damage Tolerance
- Air Vehicle Structures & Dynamics Technology
- Aviation Weapons Integration

Operations and Support:

- Propulsion and Drive Trains
- Increased Fuel Efficiency
- Lighter Weight Components
- Small Heavy Fuel Engine
- Improved Reliability and Durability
- Reduced Weight/Vibration

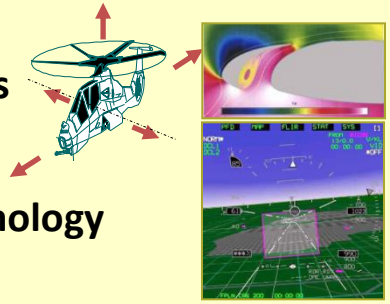


Survivability:

- Integrated ASE Architecture
- EO/IR Countermeasures
- Hostile Fire Warning & Visual Cueing
- Affordable Directional IR Jamming
- Increase Survivable Crash Envelope

Rotors & Flight Controls:

- Active Rotors and Controls
- Future Rotary Wing Concepts
- Advanced Rotor System Development
- Reconfigurable Vehicle Technology
- Reconfigurable Rotors



Unmanned Air:

- Autonomous Behaviors
- Unmanned Cargo Resupply
- Manned-Unmanned Teaming
- Video from Unmanned Aerial Systems for Interoperability Teaming (VUIT)
- Bi-Directional Remote Video Terminal (BDRVT)

Army S&T Alignment—Command, Control, and Communications Systems
6.2 and 6.3 FY12

1. Data to Decisions
2. Engineered Resilient Solutions
3. Cyber Science & Technology
4. Electronic Warfare/Electronic Protection
5. Counter Weapons of Mass Destruction
6. Autonomy
7. Human Systems

Intelligence & Electronic Warfare:

- Fusion for timely, accurate SA
- Networked EW assets for simultaneous and autonomous detection, classification, and geo-location of modern emitters/threats in all terrains
- Surgical disruption and/or neutralization of C4ISR nodes and RCIEDs

Communications:

- GIG voice/data connectivity for dismounted Soldiers
- Tactical access to military Smartphone applications
- Intrusion Detection Systems to detect/protect and reduce network downtime from cyber threats
- Cross Domain Solution for bi-directional info sharing
- Affordable phased-array antennas for OTM Satcom

Sensors:

- New growth methods and structures enabling lower cost, large format IR FPAs:
  - Superlattice & Barrier ("nBn") detectors
  - Novel digital readout integrated circuit (ROIC) technology
- Radar technologies for 360 Degree Hemispherical Coverage
- Standoff capability to characterize urban structures

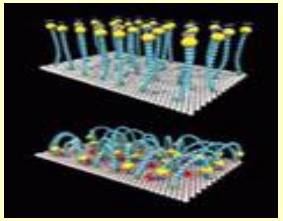
Mission Command:

- Mission-aware data mining and reasoning software agents for decision making and communications utilization
- Custom C2 applications from existing software components and services
- Mission Command software services – able to plan, deploy and manage unmanned missions
- Software for Collaboration Services and Decision Support Software Products

Army S&T Alignment—Basic Research
6.1 FY12

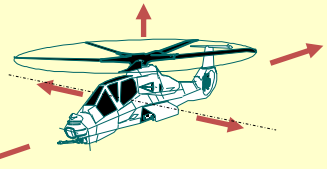
UARCs:
- Soldier Nanotechnology
- Collaborative Biotechnology
- Creative Technology
- Electromagnetics & Hypervelocity Physics

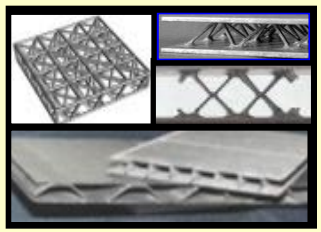
University Initiatives:
- Single Investigators
- MURI
- DURIP
- PECASE



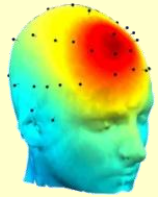
Collaborative Technology Alliances:
- Micro Autonomous Systems Technology
- Robotics
- Cognition & Neuroergonomics
- Network Science

Centers for Enduring Needs:
- Vertical Lift Research
- Materials Research
- Automotive Research
- High Performance Computing
- HBCU/MI





Inhouse Research:
- Core Programs
- ILIR

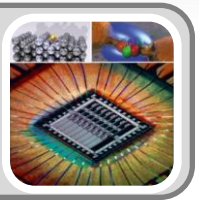


Army Basic Research Focus Areas

1. Nano Science and Engineering
2. Cognitive Neuroscience
3. Quantum Systems
4. Engineered Materials
5. Modeling of Human Behavior
6. Synthetic Biology

Quantum Effects

Generate advances in quantum sciences that will enable revolutionary approaches to information processing, cryptography, information assurance, and communication



Nanotechnology

Discover and create new materials with properties that will revolutionize military technology and make Soldiers less vulnerable to the enemy and environmental threats

Network Science

Research in human-engineered and biologically-evolved networks to improve performance, increase reliability & enhance network-centric mission effectiveness

Neuroscience

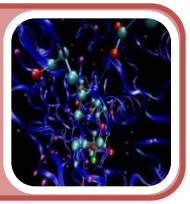
Research in learning, decision models and the functional brain to improve training techniques, human-machine interface design, and to more fully understand the decision-making process

Immersive Technology

Revolutionize military training and mission rehearsal through the development of technology and art for simulation experiences and the development of virtual human technology

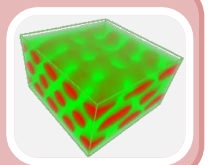
Biotechnology

Research to understand biological construction of novel materials, structures and processes to develop biologically-inspired materials, sensing systems, information processing and power & energy



Materials Modeling

Research to develop fundamental science principles at & across scales and develop underpinning, cross-cutting, and transferrable physics-based modeling capabilities



Autonomous Systems

Discover, develop and exploit robotic devices and systems with highly sophisticated sense, response and processing systems approaching that of biological systems to dramatically enhance Soldier survivability

Army Educational Outreach Program

Strategy: Follow the Path to Become Scientists and Engineers

Science Introduction – Grades K-5

NSC

Competitions and Experiences!

Competition – Grades 6-9

eCybermission, Junior Solar Sprint

Up to $7,500 in savings bonds

Lab Experiences – Grades 6-9

GEMS, Near Peer Mentor

Up to $250 stipend a week!

Competition – Grades 9-12

JSHS, IMO, ISEF

Up to $50,000 in cash & prizes!

Mentor Programs – Grades 9-12

UNITE, REAP, SEAP, HSAP/UAP

Up to $5,000 a summer!

College Programs

SEAP-CQL, WISP, CREST, CRFP, SMART

Full scholarship and up to $45,000 a year!

AEOP

http://www.usaeop.com

Executing the Strategy

The Current Basis (going in)

OSD FY 2013-17 Priority Areas

- Data to Decisions
- Engineered Resilient Systems
- Cyber S&T
- Electronic Warfare/Protection
- Counter WMD
- Autonomy
- Human Systems

Army S&T Priority Challenges !!!

Army FY 2013-17 Warfighter Outcomes

- Training
- Mission Command
- Power and Energy
- Counter IED and Mine
- Human Dimension

(156 supporting outcomes)

PLUS Unified Quest Data

Operational Experiences from 10 Years of War

ASTAG/ASTWG Process

WORKSHOP

Army FY 2014-18 Army S&T Challenges to Close High Priority Gaps*

- What: Goals , Objectives & Metrics
- When 2-3 year deliverables
- Why : Addresses high priority Army needs or new capability
- Application: Targeted Mission Areas
- Defined Capability Gap: Provides enhanced or new capability

Guidance to S&T Community

Program Building

5-10 Yr Programs 6.1/6.2

planning, vetting, identification of enabling technologies, utility analysis, identification of milestones, timing , and resourcing

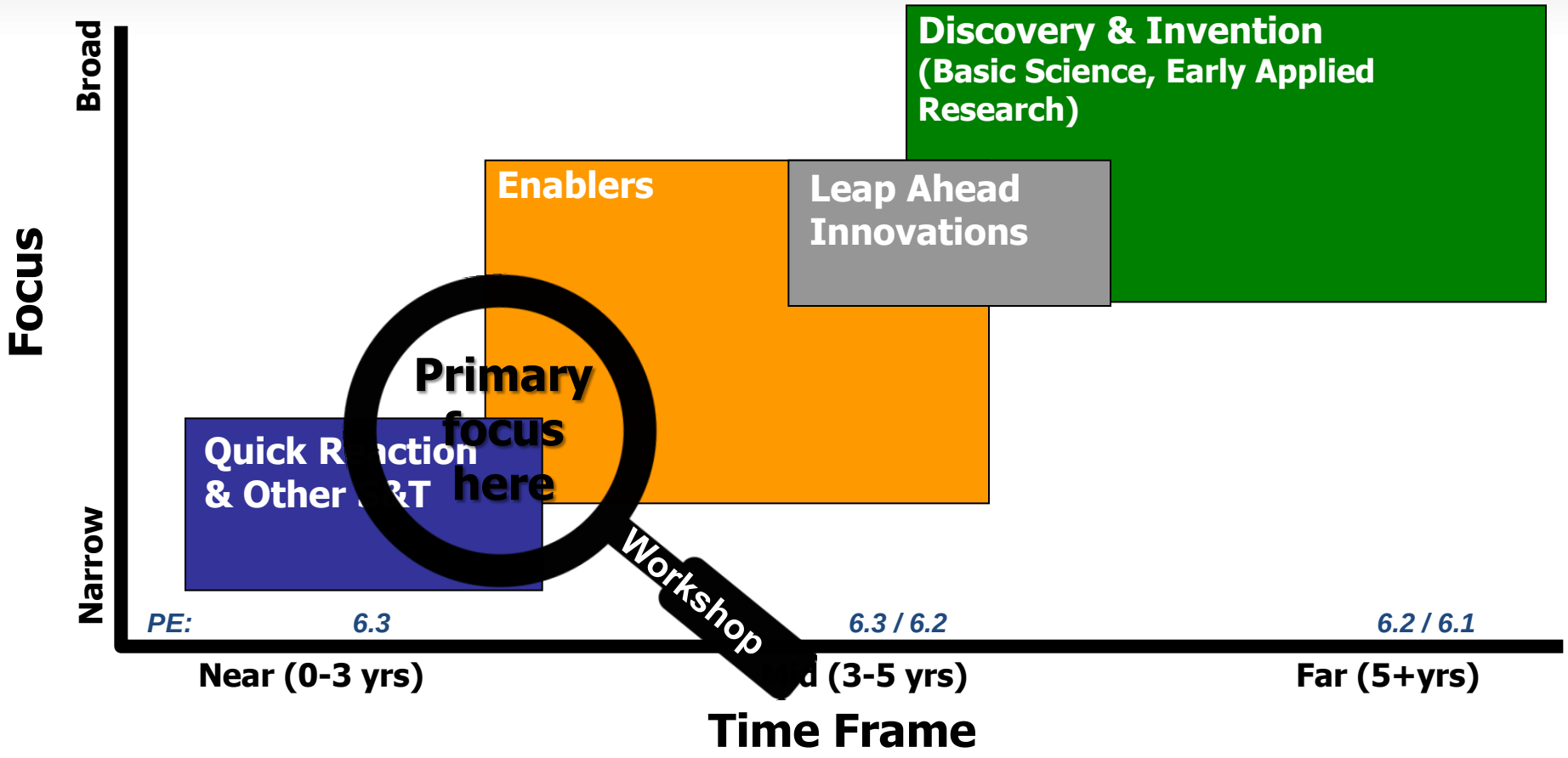
Army FY 2014-18 Technology Enabled Capability* Demonstration Programs

2-3 Yr Programs 6.2/6.3

Workshop focus

*For the first time, the Army will have Senior Leadership buy-in to Army S&T priorities

Big Challenge Action Plan
Balanced S&T Portfolio



Quick Reaction
- Tech Solutions
- Rapid insertions
- Experimentation
- JUON solutions

Enablers
- Applications research for specific military problems
- Tech insertion, integration & transition
- Componeents, subsystems, models,

Leap-Ahead Innovations
- Skunkworks, integrated evaluations, concepts & wargaming
- Innovative alternative generation, assessment, demonstration and evaluation

Discovery & Invention
- Basic & Early Applied Research
- Education Outreach
- Knowledge for uncertain future

Technology-Enabled Capability Demonstrations (TECDs)

- **Definition: A technology or set of technologies that either measurably enhance performance and effectiveness of an existing capability or enable a new and necessary capability for the Warfighter - focus on solving near term challenges that are priorities for the Army**

- **TECD Considerations**
  - **TECDs require collaborative program planning (typically cross-organization)**
  - **TECDs focus on transitioning a capability to meet an agreed upon goal at an agreed upon time**
  - **Failure of a component technology within a TECD does not necessarily equate to TECD failure**
  - **Risk management/mitigation strategies take on a new significance within the S&T community – achieving overall capability goal is key**

In Summary…

- **We are changing the Army S&T business model to be an enduring, sustainable, successful enterprise model**
- **We are aligning our strategic planning to the budget processes so that we are more efficient and able to achieve "top-down" S&T leadership investment focus**
- **We are identifying critical Army problems that we can solve in the near and mid-term, using the best talent and skills wherever they exist**
- **We are enhancing visibility of Army S&T priorities to provide partnering opportunities to jointly solve problems and enhance our Warfighter capabilities**

The better we understand our needs and priorities –
the better able our enterprise will be to give us capability solutions

My Challenge to You

- **Assist us in providing our Soldiers a decisive edge**
- **Engage in the discussions at this conference**
- **Strengthen your partnership with the Army**

You can help define the architecture, concepts, components and technology to enable the Soldier and small combat unit to achieve the capabilities needed in an environment of persistent conflict and full spectrum operations.

Army Science & Technology

Providing Soldiers Technology Enabled Capabilities

ARMY S&T
SCIENCE & TECHNOLOGY