



Army Science & Technology



NDIA 8th Annual Disruptive Technologies Conference

Army S&T Strategic Direction:

Areas for Industry Participation



Ms. Nancy Harned
Office of the Deputy Assistant Secretary
of the Army for Research and Technology

November 9, 2011



Purpose



- **To provide you with an update of the new processes we are implementing in Army S&T**
 - **Reflects Senior Leadership's priorities and synchronized to budget process**
- **To walk you through our S&T path forward and highlight opportunities for you to participate**





Army S&T Mission

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



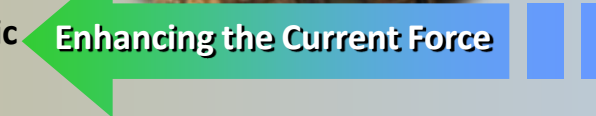
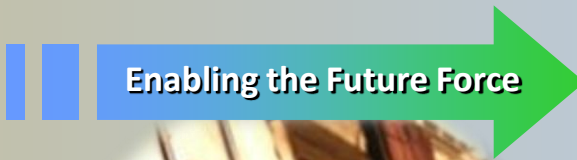
IED/Mine Detection Ground Penetrating Radar



Unattended Transient Acoustic MASINT System



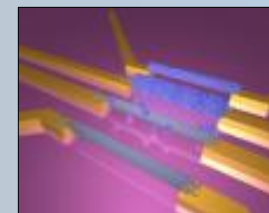
MRAP Expedient Armor Program



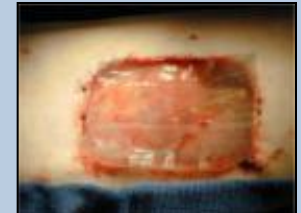
Future Force



Immersive Training



Virus-based Self-Assembling Electrodes



Regenerative Medicine

Autonomous Materiel Handling System





Army Science & Technology Vision



Vision

Provide *Technology Enabling Capabilities* that Empower, Unburden and Protect our Soldiers and Warfighters in an environment of Persistent Conflict

Our Challenge

Deliver these technologies through effective partnerships in synchronization with Army Force Generation (ARFORGEN) and fiscal processes

Respond Rapidly to Technological Evolution





Strategic Goals for Army S&T



**FY11
Focus**

**“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**

FY11 focus was on setting conditions for success





S&T Portfolios

Enduring Technologies Portfolio

Basic Research

Air Portfolio

Ground Portfolio

C3 Portfolio

Soldier (Medical) Portfolio

Soldier (Non-medical) Portfolio

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

- Environment (EQ&I) - \$2B
- Sustainable
 - Military Modernization
 - Pollution
 - Adaptive

- High Performance Modernization
- DoD Super
 - Network
 - Software

DESIGN • DEVELOP • DELIVER • DOMINATE
SOLDIERS AS THE DECISIVE EDGE

1. Nano Science
2. Cognitive
3. Quantum
4. Engineered Resilient Solutions
5. Modeling
6. Synthetic

- Information Centric
- Information Science
 - Network Science
 - Cyber

- Platform Centric
- Simulation
 - Autonomy
 - Vehicles

- People Centric
- Multidisciplinary
 - Innovative Leadership
 - Educational
 - International

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SOLDIERS AS THE DECISIVE EDGE

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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 Development
- Advanced Air Vehicle
 - Joint Multi-Role Demonstrator
 - Rotocraft Airframe
 - Platform Durability/Tolerance
 - National Rotocraft

- Engines & Drivetrains
- Increased Fuel Efficiency
 - Lightweight Drivetrain
 - Improved Reliability
 - Reduced Weight

- Aircraft & Helicopters
- Reduced Vehicle Weight
 - Threat Warning
 - Active Jammer
 - Opaque & Transparent
 - Energy Absorption
 - Air Vehicle Structure

DESIGN • DEVELOP • DELIVER • DOMINATE
SOLDIERS AS THE DECISIVE EDGE

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

- Survivability
- Vehicle Ballistics
 - Deployable Force
 - Protective Structures

- Mobility/Countermeasures
- Military Engine
 - Counter-Mine Device (IED)

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SOLDIERS AS THE DECISIVE EDGE

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

- Communications
- GIG voice/data Soldiers
 - Tactical access
 - Intrusion Detection
 - reduce network
 - Cross Domain sharing
 - Affordable phase

- Mission Command
- Mission-aware for decision making
 - Custom C2 applications
 - Mission Command components
 - Software for C2
 - Software Product

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4. Electronic Warfare/Electronic Protection
5. Counter Weapons of Mass Destruction
6. Autonomy
7. Human Systems

- Combat Casualty Reduction
- Damage Control
 - Combat Trauma
 - Combat Critical Care
 - Traumatic Brain Injury

- Clinical and Health
- Clinical and Health

DESIGN • DEVELOP • DELIVER • DOMINATE
SOLDIERS AS THE DECISIVE EDGE

1. Data to Decisions
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6. Autonomy
7. Human Systems

- Logistics Support:
- Precision Airdrop and Aerial Delivery Technologies
 - Expeditionary Mobile Base Camp
 - Technology
 - Joint Service Combat Rations and Equipment Technologies

- Human Dimension:
- Personnel Technology
 - Training /Leader Development
 - Training Tools
 - Human Systems Integration

- Soldier Protection/Load Management:
- Soldier/Small Unit Protection
 - Load Management
 - Lethality Assets

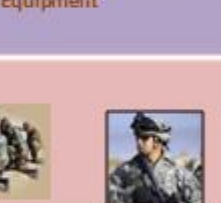
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- Soldier Electronics and Power:
- Soldier and Small Unit Operated Electronics
 - Dismounted Soldier Power
 - Soldier Sensors



DESIGN • DEVELOP • DELIVER • DOMINATE
SOLDIERS AS THE DECISIVE EDGE



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Moving from ATOs to TECDs

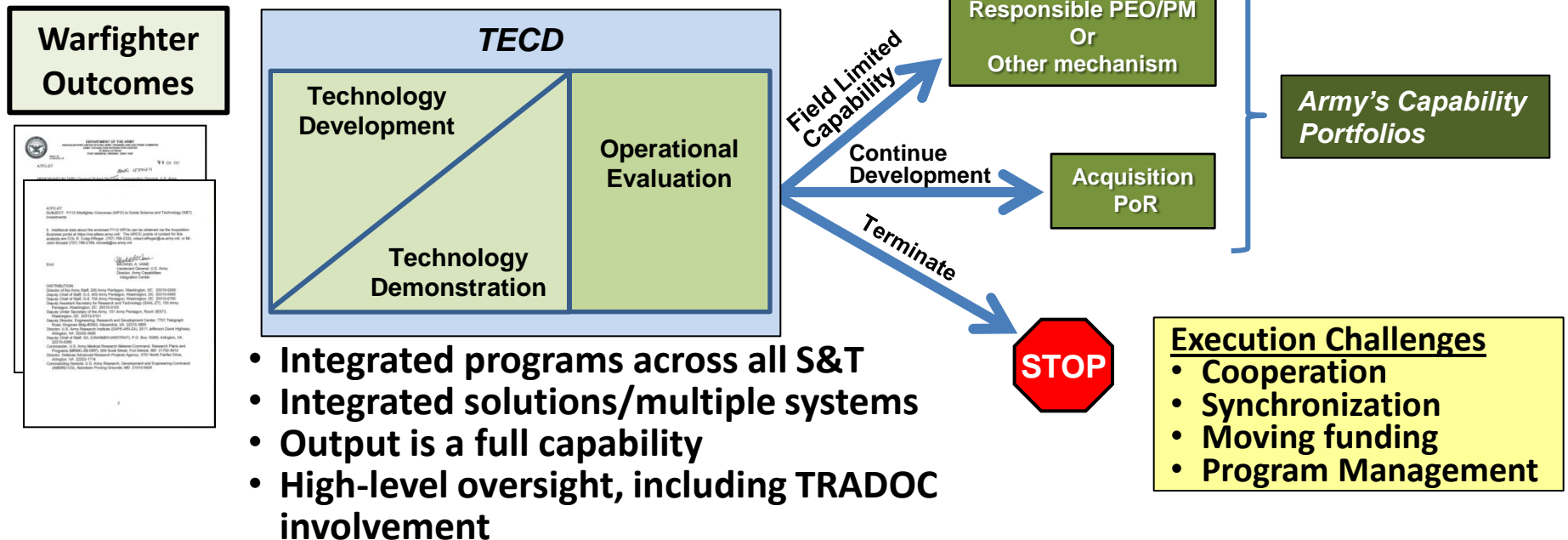
Characteristics of ATOs

- Three types of ATOs: ATO-R, ATO-D, ATO-M
- Bench-level initiatives generated from the bottom up
- Focused on individual technical objectives, not capabilities
- Mapped to Warfighter Outcomes and *endorsed* early by TRADOC schools
- Needed to be combined after S&T to provide an operational capability
- Difficulty transitioning
- Difficult for Senior leadership to understand the value of individual ATO products

Execution Challenges

- Cooperation
- Transition
- Adaptability/ Responsiveness
- Visibility & Oversight

Characteristics of Technology Enabled Capabilities Demonstration (TECD)





Big Army Problems that S&T Must Help Solve

Current focus: “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.

Problems listed in no particular order—validated by Senior Army Leadership





24 Army S&T Challenges



	Challenge #	Challenge Title
Top 5	1b	Force Protection – Soldier & Small Unit
	1c	Force Protection – Occupant Centric Platform
	2a	Overburdened – Physical Burden
	3a	Surprise/Tactical Intelligence – Mission Command
	7d	Human – Medical Assessment & Treatment
Next 5	1a	Force Protection – Basing
	7b	Human – Individual Training to Tactical Tasks
	3b	Surprise/Tactical Intelligence – Actionable Intelligence
	4a	Sustainability/Logistics – Basing
	4b	Sustainability/Logistics – Transport, Distribute & Dispose
Remaining 14	1d	Force Protection – On the Move (Ground)
	2b	Overburdened – Cognitive Burden
	3c	Surprise/Tactical Intelligence – Cultural / Linguistic
	3d	Surprise/Tactical Intelligence – Organic Combat ID
	3e	Surprise/Tactical Intelligence – Overwatch Persistent Surveillance
	3f	Surprise/Tactical Intelligence – METT-TC Data/Information/Knowledge
	3g	Surprise/Tactical Intelligence – Network
	5a	Tactical Overmatch – Deliver Decisive Effects
	5b	Tactical Overmatch – Targeting/Hand-off
	6a	Maneuverability – On the Move (Air)
	6b	Maneuverability – Degraded Visual Environment (brown-out)
	7a	Human – Strength-based Soldier Characteristic Assessments & Readiness
	7c	Human – Collective Training for Tactical Operations
	7e	Human – Trauma Management





Force Protection – Soldier and Small Unit



1.b Top 5

Problem Statement: The spectrum of threats encountered by Soldiers in Small Units is varied and complex; current equipment, clothing, and other protective measures do not provide adequate protection without adding significant mobility challenges.

Challenge: Formulate a S&T program to increase the level of individual protection for male and female Soldiers at reduced total weight and volume while enabling increased physical and mental agility, particularly over extended periods. The goal is to reduce the number and severity of injuries and casualties (including TBI and PTSD causes).

Challenge Boundary Conditions:

Who: Individual Soldiers

What: Develop technologies to increase protective gear performance while reducing weight and volume – protection from weapon threats, blast, fire, insect-borne diseases, weather conditions including excessive heat/cold, and CB threats.

How: Establish baselines 2010/2011 field collection data, injury, and use other data sources to clearly define the focus.



Objectives:

Near term (FY17): Identify trade space to enable holistic protection design and implementation on the individual Soldier and in Small Unit; optimize level and area of protection against threats while reducing total weight of individual protective gear/equipment by 50% and total volume by 30% from baseline; improve clothing, helmet, MOPP gear, fire retardancy, insect repellent, etc.



Force Protection – Occupant Centric Platform



1.c Top 5

Problem Statement: We design vehicles to put Soldiers in rather than designing vehicles around Soldiers. Increasing protection levels of the platforms impacts interior volumes reducing mobility, maneuverability, and freedom of movement for occupants and leads to heavier platforms.

Challenge: Formulate a S&T program to make improvements to existing platforms or develop new platforms that provide appropriate increased protection from current and emerging threats and optimal space allocation for Soldiers and their gear, while decreasing platform weight and maintaining or increasing maneuverability during full spectrum operations. Goal is to reduce overall platform weight by 25% and reduce casualties and WIAs by 50% across each mission role with scalable protection levels to defeat a wide range of threats, enhance mobility, and maintain freedom of action during full spectrum operations.



Challenge Boundary Conditions:

Who: TBD – for Small Unit transport and convoys

What: TBD – specify mission, vignettes, scenarios, conditions of the 2011 representative baseline

How: Establish baselines using 2010/2011 field collection data, injury, and other data sources.

Objectives:

Near term (FY17): Establish baselines; develop occupant protective standards; mature interior and exterior occupant protection technologies; increase lab testing capability; improve confidence in M&S predictions



Surprise/Tactical Intelligence – Mission Command



3.a Top 5

Problem Statement: The Small Unit lacks tools and ability to execute mission command on the move (air or ground) to synchronize action, seize the initiative and maintain situational awareness.

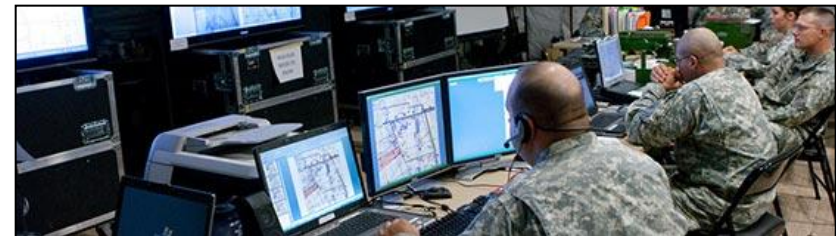
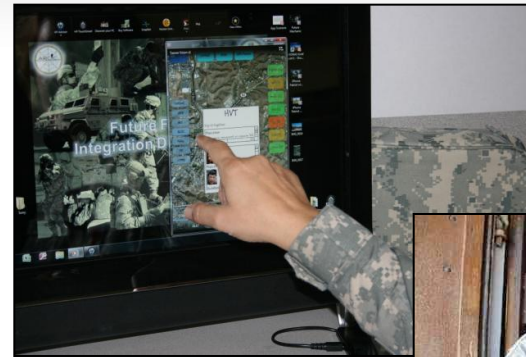
Challenge : Formulate a S&T program to provide an integrated data structure for intelligence and mission command systems that can feed automated processing and analysis tools to reduce time to decision; provide interactive tools to provide relevant, timely information to support decisions; and reduce the timeline needed to develop, accredit and field intuitive, useful, effective mission command and battlefield awareness software applications.

Challenge Boundary Conditions:

Who: Small Units operating in decentralized locations

What: Focus on TOC/COIST capability

How: Assess consolidation of Intel and Battle command decision support and analysis tools by 2015 to inform and shape Science and Technology to shorten/improve the decision cycle to figure out HOW to measure success.



Objectives:

Near term (FY17): Identify how to reduce development time for BFA software applications to 6 months, for all environments,



Overburdened – Physical Burden

2.a Top 5

Problem Statement: Soldiers in Small Units (squads/fire teams/crews) are physically overburdened, often carrying up to 130lbs; this degrades performance and may result in immediate, as well as, long term consequences.

Challenge: Formulate a S&T program to significantly reduce the weight and volume of all items that individual Soldiers in a Small Unit must physically carry to accomplish their missions while maintaining or increasing the ability of the Unit to perform tasks, whether operating as dismounted or in vehicles.



Challenge Boundary Conditions:

Who: Soldiers and Small Units operating in Afghanistan-like environments

What: Reduce physical burden within the squad so that no individual Soldier load exceeds 30% of their body weight.

How: Establish 2011 baseline for various operations and for Afghanistan-like engagement conditions. Measure impact on load (weight, volume, cube) relative to Soldier's body weight and related impacts on Small Units distribution/supply handling against baseline

Objectives:

Near term (FY17): Reduce physical burden of Soldier and Small Unit so that grenadier, SAW gunner and attached combat medic does not exceed 50% of individual's body weight without a reduction in operational capability.



Human – Medical Assessment and Treatment



7.d Top 5

Problem Statement: Traumatic brain injury (TBI) continues to be a significant issue due to IEDs and other hazards. The Army medical community is not able to promptly assess, diagnose, treat and rehabilitate Soldiers who have been exposed to ballistic and blast events or other insults.

Challenge: Formulate a S&T program to rapidly conduct in-the -field screening, assessment and mitigating treatment to improve short and long term adverse outcomes of mTBI and TBI.



Challenge Boundary Conditions:

Who: Individual Soldier and combat medic

What: Selected Operational Mission Scenarios

How: Measure the number of Soldiers correctly identified and diagnosed with mTBI/TBI without significant false positives; reduce number of evacuations due to suspected against 2011 baseline

Objectives:

Near term (FY17): Develop tools that accurately and objectively assess Soldiers with mild to moderate TBI in less than 1 hour following Soldier's return to COP/PD without increasing personnel or administrative burden.





Force Protection - Basing



1.a Next 5

Problem Statement: It takes too long and too much manpower to deploy, set up, protect, sustain and relocate Combat Outposts (COPs) and Patrol Bases (PBs).

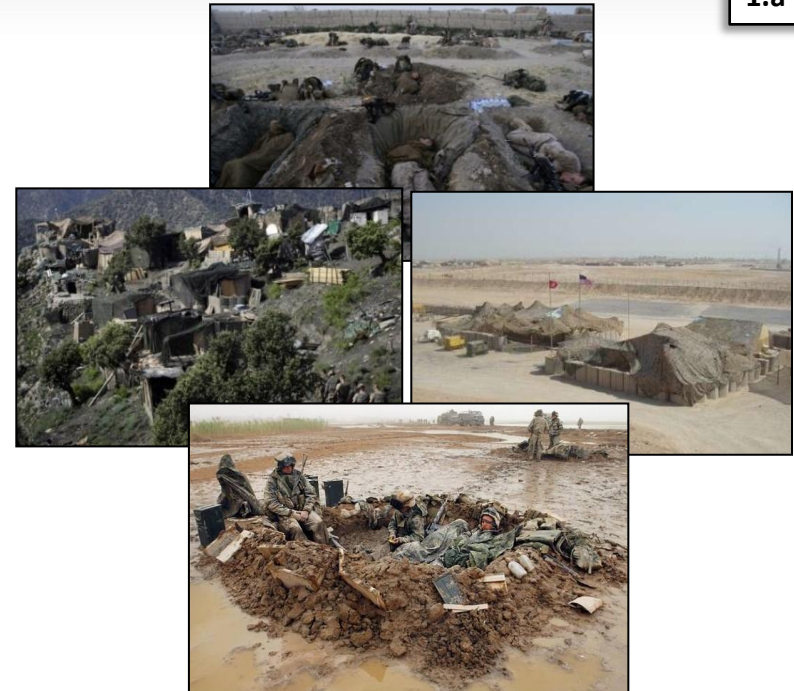
Challenge: Formulate a S&T program to reduce the percentage of Soldiers needed to set-up a COP/PB and protect against threats (including small arms, indirect fires, air delivered weapons, and CBRNE) in austere, restricted terrains.

Challenge Boundary Conditions:

Who: Focus on Combat Outposts and Patrol Bases in Afghanistan-like conditions

What: Representative 2011 COP/PBs baseline indicates that it takes 60-90 days using 70% of the manpower assets (i.e., 70% not available for mission tasks)

How: Measure impact on Soldier availability and set-up time



Objectives:

Near term (FY17): Increase Soldier availability for mission tasks vs. set-up and security tasks to 50% in 30 days with increased force protection; decrease tear-down time to no more than 4 days and increase the percentage of material reusable at next COP within 100 miles.



Human – Individual Training to Tactical Tasks



7.b Next 5

Problem Statement: The Soldier today has a larger number and more complex weapons, protective systems and communications devices with which to perform more complex missions. The Army needs a highly adaptable, versatile, easy-to-access learner –centric system of training skills and tasks that is tailored to the individual’s developmental needs through timing, content, delivery, and duration.

Challenge: Formulate a S&T program to develop self-training mechanisms which can supplement or replace trainers to monitor and track Soldier learning needs, assess and diagnose problems, and guide Soldiers through training events, provide effective performance feedback, select appropriate instructional strategies, anticipate and seek out information and learning content tailored to the learner’s needs, and provide interventions of other assistance as needed.

Challenge Boundary Conditions:

Who: Selected specific tasks (vehicle driving, maintenance mechanic, weapon operations)

What: Baseline of FY11 learning tools and methods of instruction

How: Measures of Soldier comprehension, retention and skill proficiency; determine how this changes requirements for frequency of training/retraining.



Objectives:

Near term (FY17): Develop more effective fieldable simulators and apps-based training modules for key skills and tasks that can be used whenever and wherever Soldiers need to be trained/retrained/certified; develop a mechanism to automatically collect and document proficiency levels that are accessible to leaders.





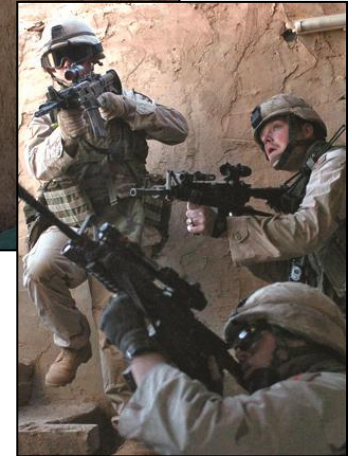
Surprise/Tactical Intelligence – Actionable Intelligence



3.b Next 5

Problem Statement: Small Units do not have capability to send/receive critical tactical intelligence; the tools or training to help them recognize/identify friends or foes, to know where IEDs are, to see inside buildings and around corners or over hills; or awareness of cultural patterns that might indicate imminent danger.

Challenge: Formulate a S&T program to provide Small Units with tools and training to efficiently collect, process, exploit, and disseminate data to support situational awareness and decision making without adding more Soldiers or significantly increasing weight or number of devices.



Challenge Boundary Conditions:

Who: Small Units operating COIN/Stability Operations in Afghanistan-like conditions

What: Goal is to provide the ground unit a common operational picture in real time to identify friendly forces in a given AO with 90% accuracy and maintain 90% probability of determining threat interdiction.

How: Measure reduction in unanticipated threat encounters, reduction in loss of equipment and loss of life (friendly/non-combatant) against 2011 baseline.

Objectives:

Near term (FY17): Provide timely accurate/actionable info/intel to obtain in 25% reduction in unanticipated threat encounters at the squad level and increase mission accomplishment (%) measured against loss of life and equipment by 50%





Sustainability/Logistics – Basing



4.a Next 5

Problem Statement: The Army needs improved capability to enable sustainment independence/“self-sufficiency” and to reduce sustainment demands at expeditionary basing levels. It is too costly, too unpredictable, and too labor intensive for a Small Unit to carry all required consumables to last for weeks or months at a COP/PB, storage facilities and systems do not meet needs of these small bases, and resupply efforts are highly unpredictable.

Challenge: Formulate a S&T program to increase self-sufficiency, reduce supply demands, and reduce waste at COPs/PBs and improve the ability to sustain the Small Unit for the duration of the mission at lower cost and lower risk to suppliers without adversely impacting primary mission Soldier availability.

Challenge Boundary Conditions:

Who: Small Units in Afghanistan-like environments

What: Identify tools, tactics, and techniques to achieve demand reduction.

How: Measure demands for power, water and fuel; waste generated and/or waste-to-energy power; weight/volume of food; time to resupply.



Objectives:

Near term (FY17): reduce need for fuel resupply by 20%, reduce need for water resupply by 75% and decrease waste by XX% while increasing quality of life over 2011 COPs/PBs in Afghanistan



Sustainability/Logistics – Transport, Distribute & Dispose



4.b Next 5

Problem Statement: The Army needs improved capability to tactically transport and reliably deliver consumables to Forward Operating Bases (FOBs) and smaller satellite bases in remote, dispersed, austere locations with reduced supplier and equipment risk, including improved efficient and safe methods for disposing waste.



Challenge: Formulate a S&T program to leverage all available conveyance modes to ensure supply delivery, to increase the reliability and timeliness of supplies delivery, and to be able to predict when and where all classes of supplies will be needed. In addition, the program will devise methods to reduce waste and use it to provide power.



Challenge Boundary Conditions:

Who: For Forward Operating Bases with applications to expeditionary bases (Small Units in COPs and PBs)

What: Rapidly deliver significant quantities (volume, weight, etc) of supplies. Air drop and convoy operations - develop ability to conduct rapid movement of emergency, planned, or critical logistics support that enables precise delivery of supplies and repair parts to forward battlefield locations, medical evacuation operations and relief operations

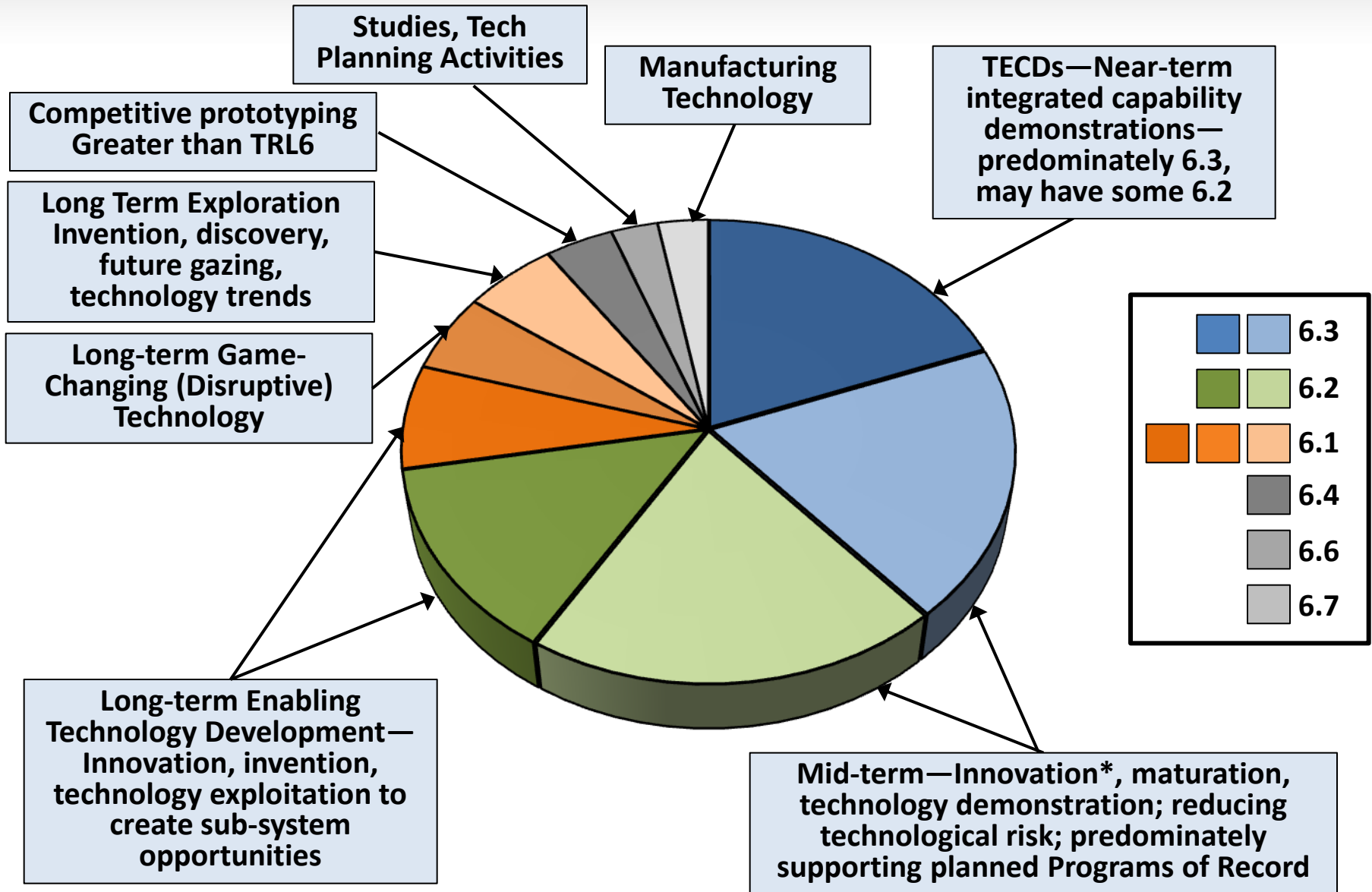
How: Representative 2011 Afghanistan-like environment baseline

Objectives:

Near term (FY17): Develop tools that efficiently manage, track, redirect, account for and distribute supplies to support forced entry, early entry, and non-contiguous operations



New S&T Investment Strategy



* Includes Rapid Innovation Funding





Defense Contractors with IRAD Investments (how can you play?)



- **We are interested in learning about your Industry IRAD efforts if you believe they are relevant to our solution set**
- **We offer you an opportunity to come talk with us about these efforts and how you can contribute to solutions for high priority challenges.**
- **We look forward to fostering opportunities to collaborate/partner with to develop concrete S&T programs to address Army capability challenges**
- **As appropriate, we will also provide opportunities for you to meet with our Portfolio Managers**





Small Business and don't have IRAD (how can you play?)



- **We are interested in learning about your technologies if you believe they are relevant to our solution set**
- **We offer Small Business priority consideration for participation in the Army Rapid Innovation Fund**
- **We look forward to fostering opportunities to collaborate/partner with you to develop concrete S&T programs to address Army capability challenges**
- **As appropriate, we will also provide opportunities for you to meet with our Portfolio Managers**

In addition to the Small Business Innovative Research program





Opportunities



- **Army Rapid Innovation Fund (RIF)**

- **Status**

- **BAA released the September 30**

- **Guidelines**

- **Executed under Broad Agency Announcements for candidate proposals in direct support of major acquisition and priority programs**
- **The total amount of funding provided to any project under the program shall not exceed \$3,000,000, unless the Secretary, or the Secretary's designee, approves a larger amount of funding for the project.**
- **No project shall be funded under the program for more than two years, unless the Secretary, or the Secretary's designee, approves funding for any additional year.**
- **Selection criteria includes:**
 - **Meeting Army Top 10 Challenge areas**
 - **Meeting critical national security needs**
 - **Reduced acquisition or life cycle costs**
 - **Likelihood of fielding within 3 years**
 - **Clarity of goals and metrics**
 - **Innovation**





If you are in Academia (how can you play?)



- **We are interested in learning about your technologies if you believe they are relevant to our solution set**
- **We offer you an opportunity to participate independently or as a team member in the Rapid Innovation Fund**
- **We look forward to fostering opportunities to collaborate/partner with you to develop concrete S&T programs to address Army capability challenges**
- **As appropriate, we will also provide opportunities for you to meet with our Portfolio Managers**





Contact info

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Army Science & Technology



Providing Soldiers Technology Enabled Capabilities



Backup



Enduring Technologies Portfolio



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**

Environmental Quality & Installations (EQ&I)

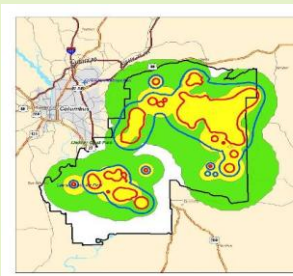
- Sustainable Ranges and Lands
- Military Materials in the Environment
- Pollution Prevention
- Adaptive and Resilient Installations



Pyrotechnic Simulator



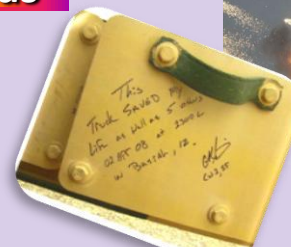
Endangered Species



Noise Assessment Model Output

High Performance Computing Modernization Program (HPCMP) **Supports PSC Areas**

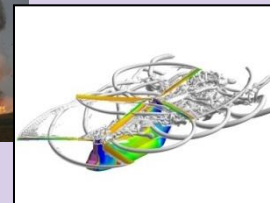
- DoD Supercomputing Resource Centers
- Networking
- Software Applications



FRAG6 and MRAP



Vehicle Blast



CH47 Advanced Rotor Assessment





Basic Research

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

Human Centric

- Life Science
- Cultural and Behavioral
- Training
- Neuroscience
- Medical



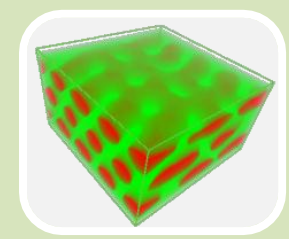
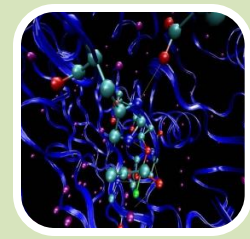
Information Centric:

- Information Science
- Network Science
- Cyber



Material Centric:

- Environmental, Chemical, Physics, Electronics, Photonics, Mechanical, Materials, and Quantum Sciences
- Materials Modeling
- Biotechnology
- Nanotechnology
- Environmental



Platform Centric:

- Simulation
- Autonomy
- Vehicles



People Centric:

- Multidisciplinary Research Initiatives
- Innovative Lab Research
- Educational Outreach Activities
- International Technology Watch





Air Portfolio

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**

Maintainability & Sustainability

- **Reduced Maintenance Actions**
- **Improved Reliability**
- **Improved Mission Readiness**
- **Reduced Spares Logistics**



Platform Design & Structures

- **Advanced Air Vehicle System Concepts**
- **Joint Multi-Role Technology Demonstrator**
- **Rotorcraft Airframe Technology**
- **Platform Durability and Damage Tolerance**
- **National Rotorcraft Technology Center**



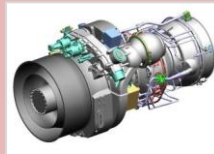
Rotors & Vehicle Management

- **Improved Vehicle Performance**
- **Reduced Vibrations**
- **Reduced Acoustic Signature**
- **Adaptive Vehicle Management**



Engines & Drive Trains

- **Increased Fuel Efficiency Engines**
- **Lightweight Drive Trains**
- **Improved Reliability and Durability**
- **Reduced Weight/Vibration**



Aircraft Weapons & Sensors

- **Aviation Weapons and Integration**
- **Pilotage Sensors and Displays**



Aircraft & Occupant Survivability

- **Reduced Vehicle Signatures**
- **Threat Warning Sensors**
- **Active Jammers & Decoys**
- **Opaque & Transparent Armor**
- **Energy Absorbing Seats & Landing Gear**
- **Air Vehicle Structures & Dynamics Technology**

Unmanned & Optionally Manned Systems

- **Common Human Machine Interface**
- **Sensor Payloads**
- **Increased Levels of Autonomy**
- **Manned-Unmanned Intelligent Teaming**



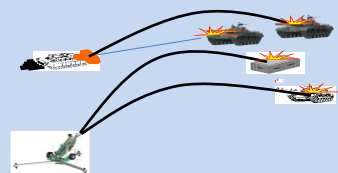



Ground Portfolio


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**

Weapons


- Fire Support
- Close Combat
- Protective Fires
- High Energy Lasers & High Power Microwaves
- Munitions / Warheads / Enablers

MEMS Inertial Navigation

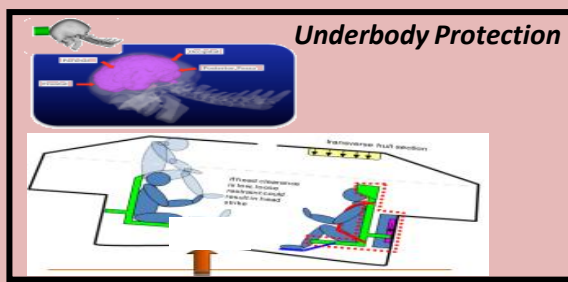


High Energy Laser

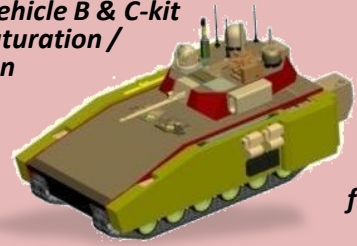


Multi-Purpose Warhead

- ## Survivability
- Vehicle Ballistic & Blast Protection
 - Deployable Force Protection
 - Protective Structures




Combat Vehicle B & C-kit Armor Maturation / Integration



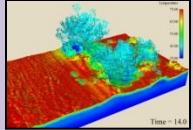
Multi-functional Armor

Mobility/Counter-mobility

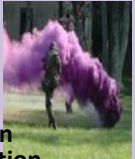
- Military Engineering & Obscurants
- Counter-Mine/Improvised Explosive Device (IED)




Digital GPR



Sensor Scene Generation: Best Times for Target ID




Obscured Materials




Precision Neutralization

Ground Platforms


- Power & Mobility
- Unmanned Systems
- Logistics



Microgrids



Autonomous Platform Demonstrator



Alternative Fuels



C3 Portfolio

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 geolocation 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



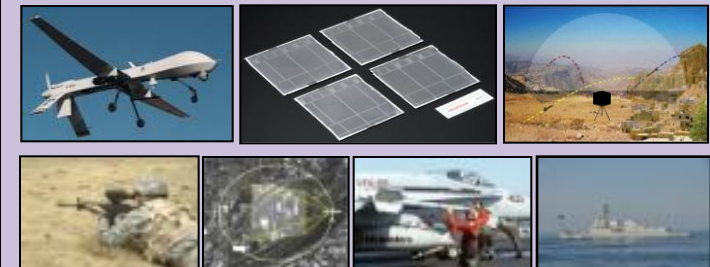
Mission Command:

- **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



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





Soldier (Medical) Portfolio

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**

Infectious Disease Research

- **Drugs to Prevent/Treat Parasitic Diseases**
- **Vaccines for Prevention of Malaria**
- **Viral Threat Research**
- **Bacterial Threats**
- **Diagnostics and Disease Transmission Control**



Combat Casualty Care:

- **Damage Control Resuscitation**
- **Combat Trauma Therapies**
- **Combat Critical Care Engineering**
- **Traumatic Brain Injury**



Military Operational Medicine

- **Environmental Health and Protection**
- **Injury Prevention and Reduction**
- **Psychological Health**



Clinical and Rehabilitative Medicine

- **Clinical and Rehabilitative Medicine**





Soldier (Non-medical) Portfolio

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**

Logistics Support:

- Precision Airdrop and Aerial Delivery Technologies
- Expeditionary Mobile Base Camp
- Technology
- Joint Service Combat Rations and Equipment Technologies



Human Dimension:

- Personnel Technology
- Training /Leader Development
- Training Tools
- Human Systems Integration



Soldier Protection/Load Management :

- Soldier/Small Unit Protection Load Management
- Lethality Assets



Soldier Electronics and Power:

- Soldier and Small Unit Operated Electronics
- Dismounted Soldier Power
- Soldier Sensors

