

# Army Science & Technology



## NDIA 11th Annual Science & Engineering Technology Conference

*Providing Soldiers the Technology Edge*

Charleston, SC



Dr. Thomas H. Killion  
Deputy Assistant Secretary of the Army  
for Research and Technology/  
Chief Scientist



13 April 2010



# Researcher Translation

IF A RESEARCHER SAYS A COOL  
NEW TECHNOLOGY SHOULD BE  
AVAILABLE TO CONSUMERS IN...

WHAT THEY MEAN IS...

THE FOURTH QUARTER OF NEXT YEAR	THE PROJECT WILL BE CANCELED IN SIX MONTHS.
FIVE YEARS	I'VE SOLVED THE INTERESTING RESEARCH PROBLEMS. THE REST IS JUST BUSINESS, WHICH IS EASY, RIGHT?
TEN YEARS	WE HAVEN'T FINISHED INVENTING IT YET, BUT WHEN WE DO, IT'LL BE AWESOME.
25+ YEARS	IT HAS NOT BEEN CONCLUSIVELY PROVEN IMPOSSIBLE.
WE'RE NOT REALLY LOOKING AT MARKET APPLICATIONS RIGHT NOW.	I LIKE BEING THE ONLY ONE WITH A HOVERCAR.



A webcomic of romance, sarcasm, math, and language.

<http://xkcd.com>



DESIGN • DEVELOP • DELIVER • DOMINATE  
WE MAKE SOLDIERS STRONG

ARMY S&T  
SCIENCE & TECHNOLOGY

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# Army S&T Principles and Vision

Fostering innovation and accelerating/maturing technology to enable Future Force capabilities while exploiting opportunities to rapidly transition technology to the Current Force

## Current Force



Modular Protective Systems



IED/Mine Detection Ground Penetrating Radar

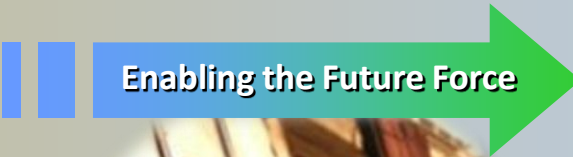


Unattended Transient Acoustic MASINT System

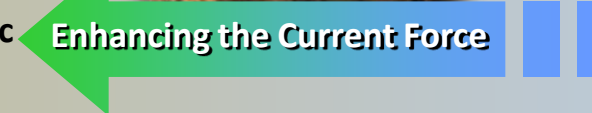


MRAP Expedient Armor Program

Enabling the Future Force



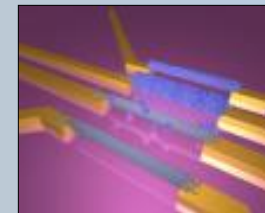
Enhancing the Current Force



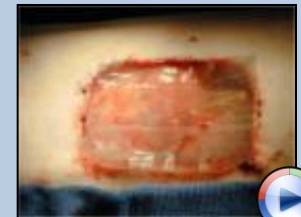
## Future Force



Immersive Training

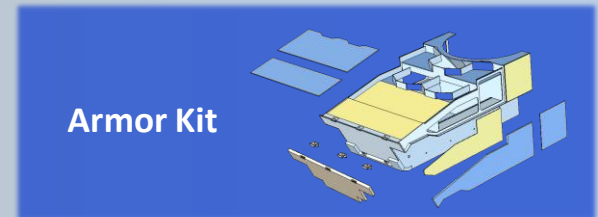


Virus-based Self-Assembling Electrodes



Regenerative Medicine

Armor Kit





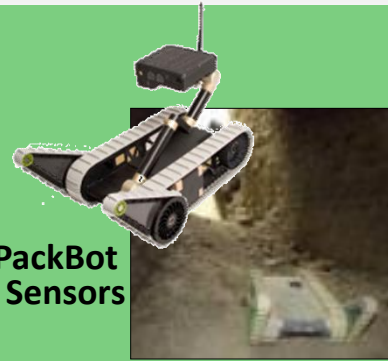
# 3 Ways Scientists and Engineers Support Current Operations—Force Protection Examples

Benefiting from Past Investments

Interceptor Body Armor



PackBot Sensors



2<sup>nd</sup> Gen FLIR



Adapting/  
Accelerating  
On-going S&T  
Programs



Cerberus Sensor Suites



Staff Toolkit for Rapid Incident Prediction and Evaluation (STRIFE)



Mine Detecting Ground Penetration Radar (GPR)



Leveraging  
Scientist &  
Engineer  
Expertise

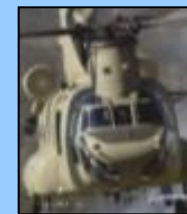
Wolfhound



MRAP Enhanced Armor



Low Contrast Visual Paint System



# S&T Products Fielded through the Rapid Equipping Force



Route Clearance Camera

## Communications Electronics RDEC



Ghost



Rucksack Enhanced Portable Power System (REPPS)

## Armaments RDEC



CROWS/PDCue Lightning

## Engineer RDC



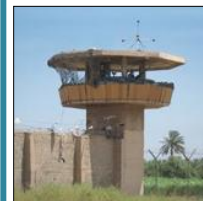
Overhead Cover

## Tank Automotive RDEC



RAZORBACK with Objective Gunner Protection Kit

## Army Research Lab



Unattended Transient Acoustic MASINT System



Atlas



Myth

## Medical Research and Materiel Command



Improved First Aid Kit



Combat Gauze



# *Army S&T Strategy*

- **Understand and exploit emerging science and technology**
- **Selectively invest to develop / adapt and mature technologies for Army unique needs**
- **Use Warfighter Outcomes to focus investments on specific needs**
- **Collaborate with and leverage other Services, agencies, international partners and the private sector**
- **Partner with PEO/PMs and rapid acquisition agents to facilitate technology transition**
- **Sustain a vital in-house workforce and laboratory infrastructure**



# Resourcing the Strategy

## 3 Types of S&T Funding

As of FY11 PB

**S&T**  
(RDT&EB  
A 1-3)

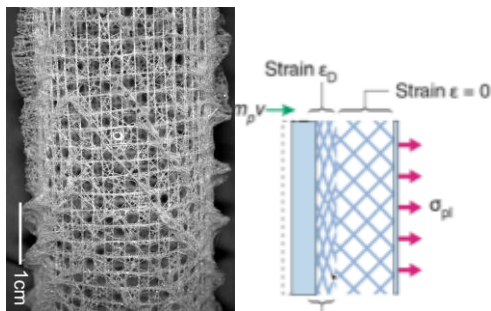
**Development** (RDT&E BA 4-7)  
\$8.4B (5.8% of TOA, 26.5% of RDA)

**Acquisition** (Procurement Appropriation)  
\$21.3B (14.99% TOA, 67.4% RDA)

**\$1.9B (1.4% TOA 6.1% RDA)**

**6.1: Basic Research**  
\$407M (21% of S&T)

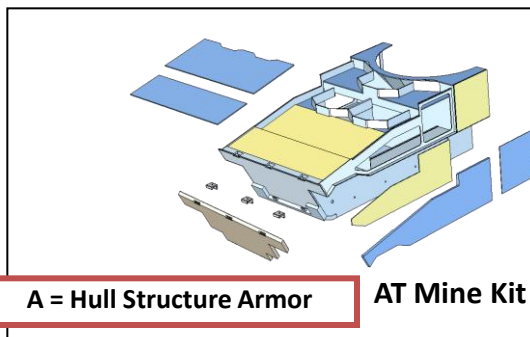
Nano/micro Assemblies



- Understanding to solve Army-unique problems
- Knowledge for an uncertain future

**6.2: Applied Research**  
\$841M (43% of S&T)

A+B & A/B Bonded Armor Concept



A = Hull Structure Armor

AT Mine Kit

B<sub>x</sub> = Laminate Composite  
Ceramic Armor

- Applications research for specific military problems
- Components, subsystems, models, new concepts

**6.3: Advanced Technology Development**  
\$697M (36% of S&T)

MRAP EFP Armor Kits



- Demonstrate technical feasibility at system and subsystem level
- Assess military utility
- Path for technology spirals to acquisition—rapid insertion of new technology

64% Universities/Industry

33% Industry

60% Industry

**Far Term**

**Mid Term**

**Near Term**

10-20 yrs

5-10 yrs

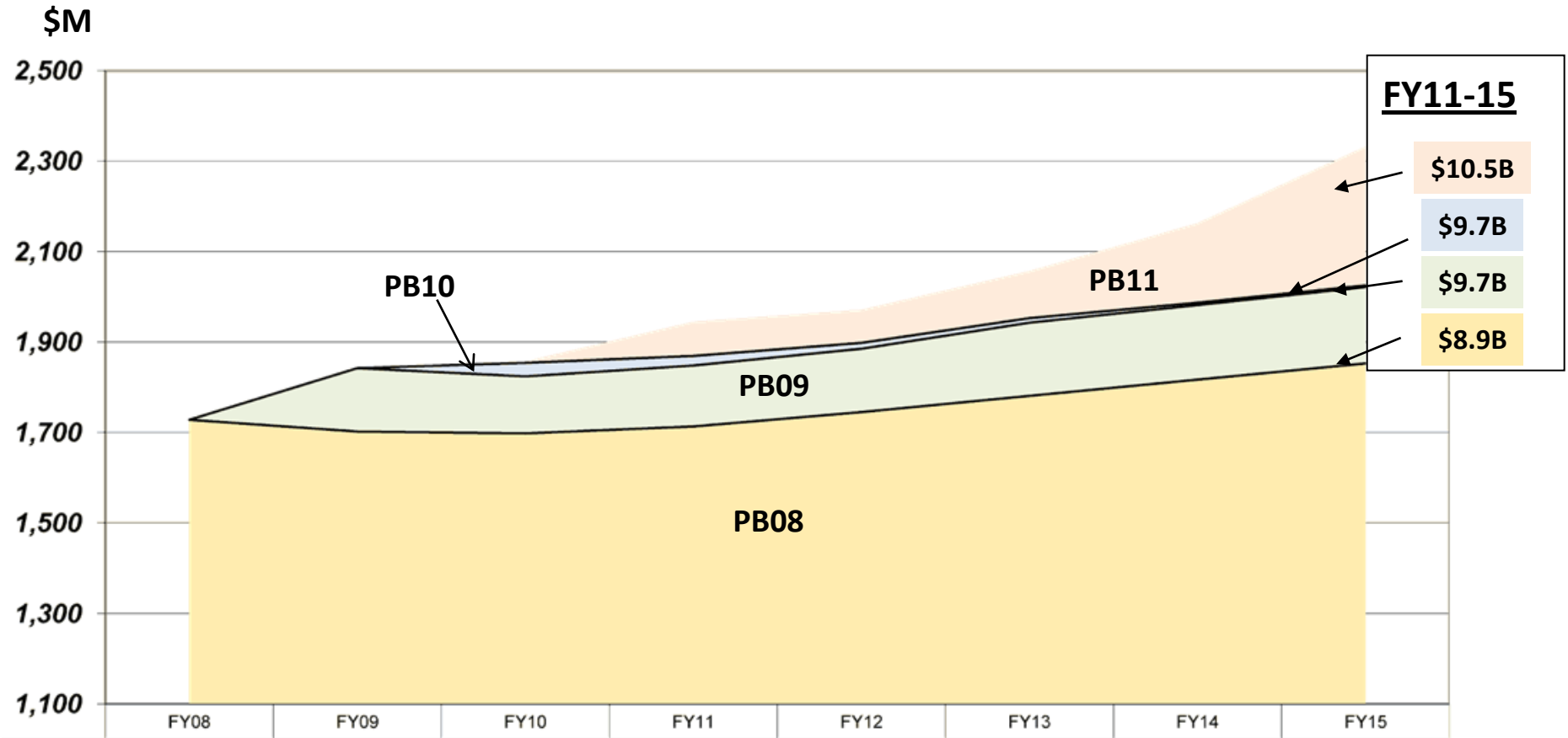
0-5 yrs

**S&T Technologies Transition to Acquisition**



# Army S&T Investment Trends FY08 PresBud to FY11 PresBud

Then year dollars





# Major Investment Shifts from FY10 to FY11PB Request

## • Deployable Force Protection Task Force (\$169M FY11-15)

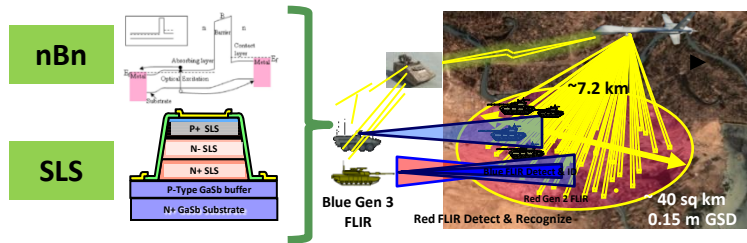
Pre-detonation screen



Requires no  
Specialized  
Personnel or  
Equipment



## • Infrared (IR) Focal Plane Array (\$93.5M FY11-15)

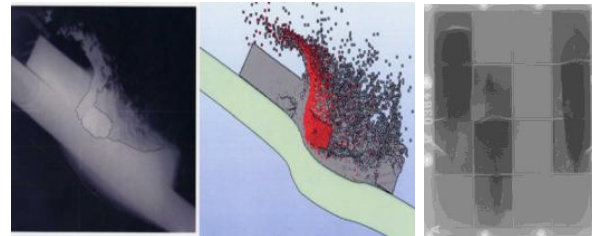


Develop very large format, high operating temperature and dual band, IR arrays w/digital readout integrated circuits



Infrared (IR)  
Focal Plane Array Technology

## • Enhancements to Research (\$27M FY11)



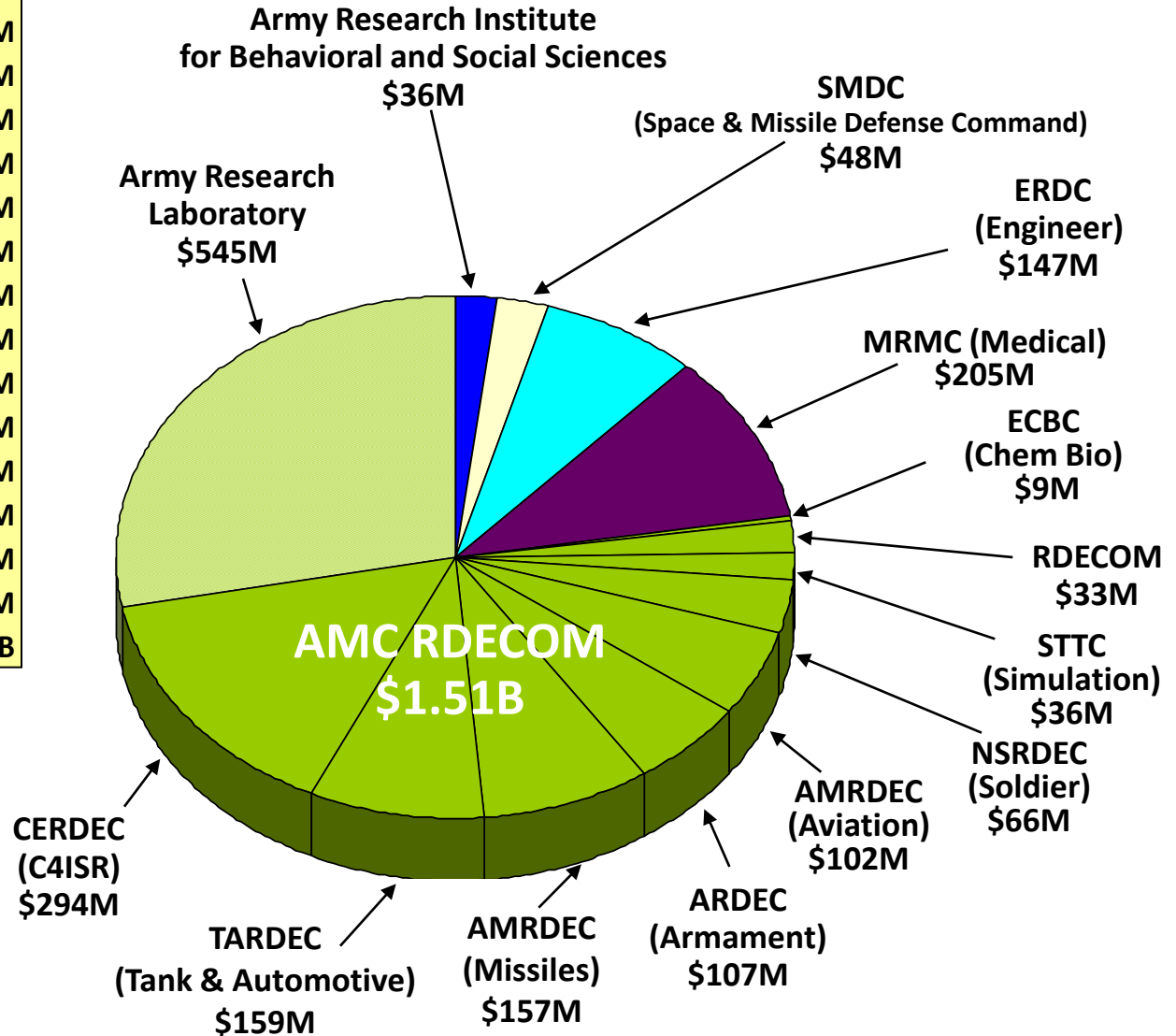
Armor  
Research



# FY11 Investments by S&T Performer

As of FY11 PB

Lab	FY11
Army Research Lab	\$545M
CERDEC (C4ISR)	\$294M
MRMC (Medical)	\$205M
TARDEC (Tank & Automotive)	\$159M
AMRDEC (Missiles)	\$157M
ERDC (Engineer)	\$147M
ARDEC (Armament)	\$107M
AMRDEC (Aviation)	\$102M
NSRDEC (Soldier)	\$66M
SMDC	\$48M
STTC	\$36M
Army Research Institute	\$36M
RDECOM	\$33M
ECBC	\$9M
<b>FY11 S&amp;T Total</b>	<b>\$1.9B</b>

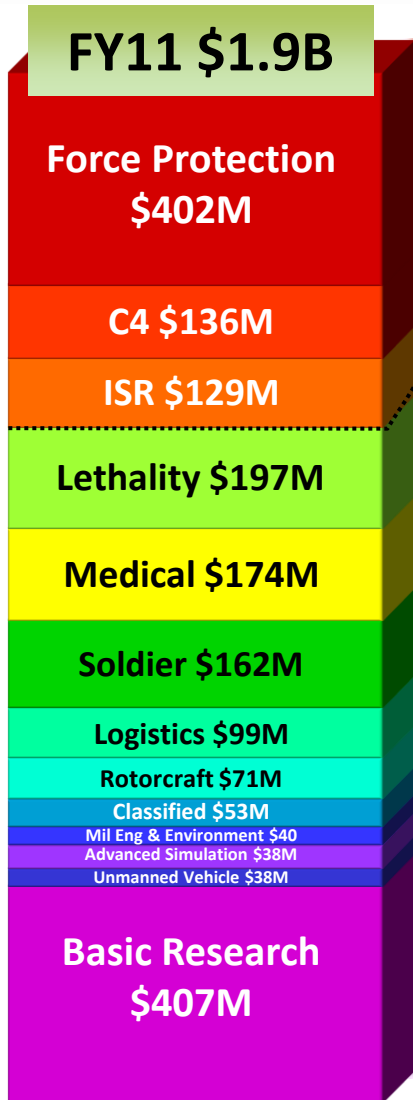






# Technology Area Investments to Satisfy Gaps / Provide New Capabilities

As of FY11 PB



*Enabling  
the  
Future Force*

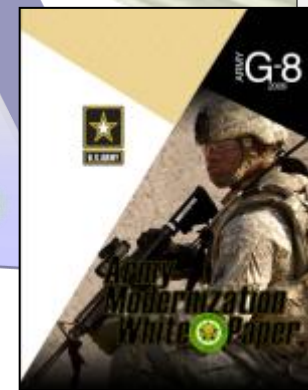
*Enhancing  
the  
Current Force*



## 10 Comprehensive Warfighter Outcomes

- *Battle Command Network*
- *Counter IED and Mine*
- *Power and Energy*
- *Human Dimension*
- *Training*
- *Force Protection*
- *Battlespace Awareness*
- *Force Application*
- *Logistics*
- *Unmanned Systems Operations*

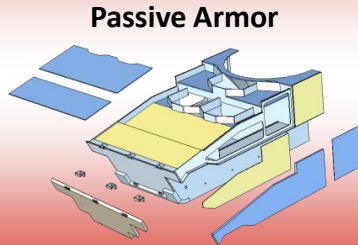
High Technology Army ARMY S&T





# Future Force Technologies

## Force Protection



Passive Armor



High Energy Laser



## KE Active Protection System



Deployable Force Protection

- Capabilities to
- Detect
- Assess
- Defend
- Warn

## C4/ISR



Sense Thru Wall

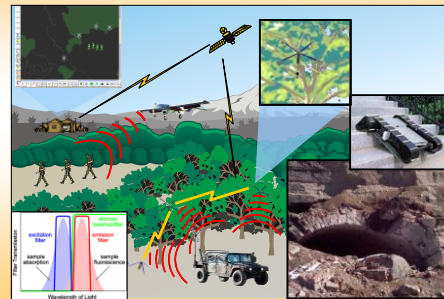


Knowledge Fusion

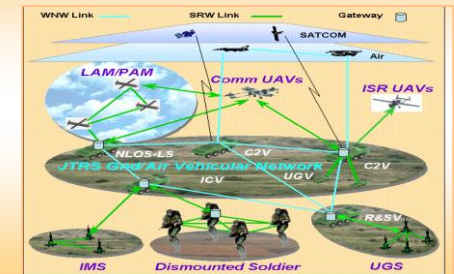


Flexible Displays

## Measurement and Signature Intelligence (MASINT)



## Tactical Mobile Networks



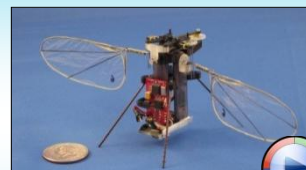
## Unmanned/Autonomous Systems



MAV



WASP



Daedal

Unmanned Aerial Vehicles

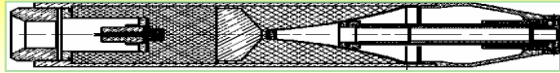
## Unmanned Ground Vehicle Technologies



# Future Force Technologies

## Lethality

### Urban Assault Munitions



### Scalable Effects



### Small Arms Technology

### Warhead



### Non Line of Sight – Launch System (NLOS-LS)



<p>Seeker Miniaturization &amp; Cost Reduction</p>	<p>Multi-Purpose Warheads to Defeat Armor, Fortifications &amp; Personnel</p>	<p>Electronics Miniaturization &amp; Cost Reduction</p>	<p>Novel Maneuver Techniques</p>
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### Smaller, Lighter, Cheaper Munitions

## Soldier Systems

### Combat Rations

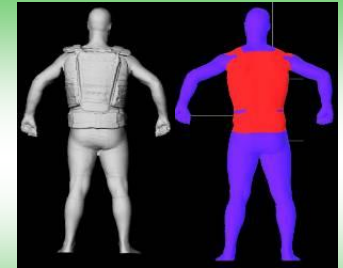


### Soldier Mobility and Advanced Load Carriage



### System Flame Test

### LiCFx Half-Size BA-5590 Battery



### Armor Coverage

## Logistics

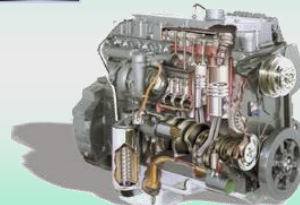
### Power & Energy



### Hybrid Electric Drive



### Fuel Cell Development



### Advanced Hybrid Engines

### Segmented Band track



### Precision Air Drop 30k lbs





# Fielded Transition Successes

## Force Protection



HMMWV Expedient Armor



Mine Resistant Ambushed Protected Armor

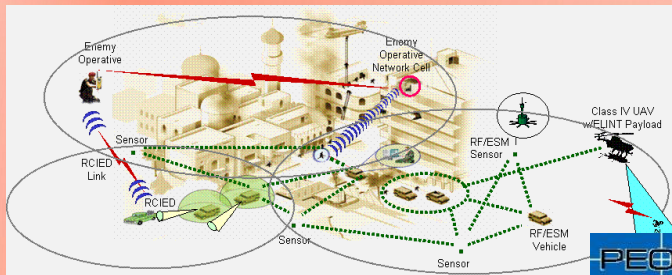


Enhanced Rocket, Mortar & Sniper Detection

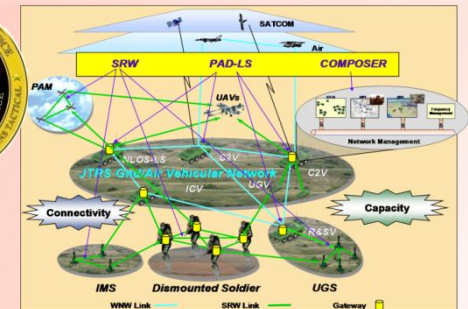


Mine Detecting Ground Penetration Radar (GPR)

## C4/ISR



Network Electronic Warfare



Tactical Mobile Networks

## Lethality



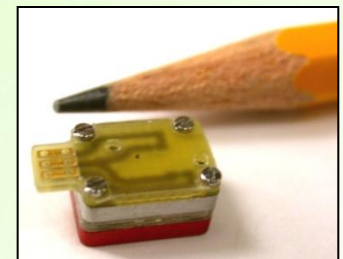
GMLRS-Unitary Warhead



Optimization of Picatinny Arsenal explosive (PAX)-41



MEMS IMU



MEMS Safe & Arm for Projectile Devices

# Fielded Transition Successes

## Advanced Simulation



Learning with Adaptive Simulation and Training

## Mobile Counter-IED Interactive Trainer (MCIT)



## Rotorcraft



Apache Split-torque Face Gear



Embedded Tail Cone Sensors



Fatigue



Corrosion



Wear

Condition-based Maintenance

## Medical



Fluid Resuscitation Technology to Reduce Injury and Loss of Life on the Battlefield



Improved First Aid Kit



Combat Gauze

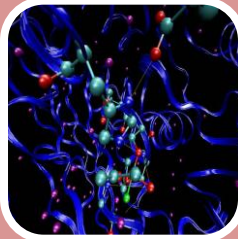




# Basic Research Thrusts

## Biotechnology

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



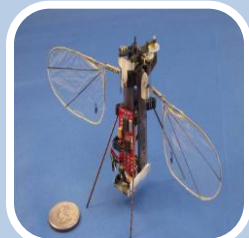
## Autonomous Systems

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



## 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

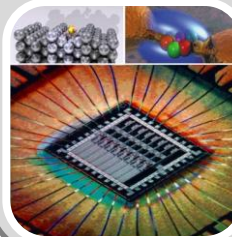


## Immersive Technology



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

## Quantum Information Science



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



# Partnering—leveraging other Services, Agencies, Academia, Industry & International

## Other Services

- Air Force
- Navy/USMC



PTSD treatment

Versatile, Affordable,  
Advanced Turbine Engine



## Agencies

- DARPA
- DTRA
- DoE labs
- DHS
- NIH
- NASA

Micro Air Vehicle



NLOS-LS

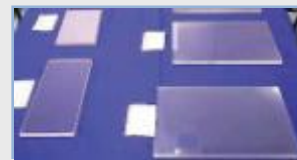
## Academia

- Georgia Tech
- MIT
- Penn State
- USC
- UMd
- UC System
- Delaware
- Michigan
- Arizona State
- 
- 

## Industry

- Primarily technology development to create options for PMs
- Small Business Innovation Research—solutions from non-traditional sources
- Army Venture Capital Initiative—dismounted Soldier power

Transparent Armor—  
Technology  
Assessment &  
Transfer, Inc.



## International

- The Technical Cooperation Program (US, UK, CA, AUS, NZ)
- NATO Research & Technology Organization
- Bilateral Agreements (UK, CA, IS, FR, GE...)



Co-investment with  
UK to advance state-  
of-the-art in network  
science



# Fostering Science and Engineering Careers



<http://www.usaeop.com>



Students participating in bridge building exercise at George Washington University



**SMART**  
SCIENCE, MATHEMATICS & RESEARCH FOR TRANSFORMATION  
PART OF THE NATIONAL DEFENSE EDUCATION PROGRAM



**Experiences**

**Careers**



Student in bio-suit at Walter Reed Army Institute for Research



**Competitions**



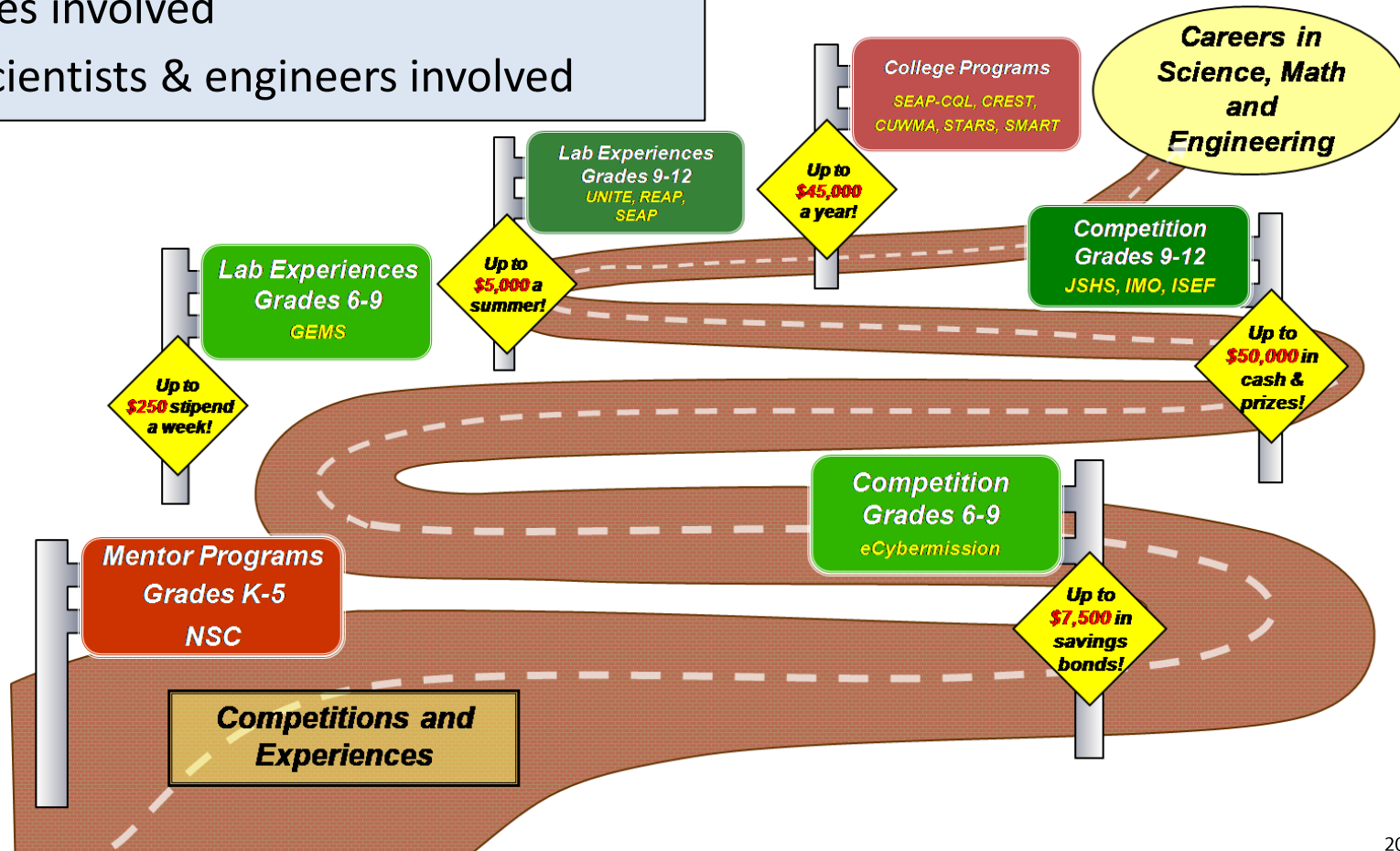
**Tomorrow's Technology is in the Minds of Today's Youth**



# Army Educational Outreach Program

- Direct oversight to 15 programs
- 76,668 K-12 students engaged
- 7,798 K-12 teachers engaged
- 430 universities involved
- 1,266 Army scientists & engineers involved

2008/2009 Data





# 27th Army Science Conference

29 November – 2 December, 2010, Orlando, Florida

## Theme: “Transformational Army Science & Technology — Enabling Full Spectrum Operations”

- Featured talks by eminent scientists and engineers from the U.S. and foreign governments, academia and industry
- Over 90 oral and approximately 300 poster presentations
- Exhibits of cutting-edge S&T
- Features papers and posters judged as best among those submitted
- Paper **Summary due May 14, 2010**
- Conference registration opens **August 2010**



Visit the 27<sup>th</sup> ASC webpage at [www.armyscienceconference.com](http://www.armyscienceconference.com)



# *Army Science & Technology*



*Providing Soldiers the Technology Edge*

