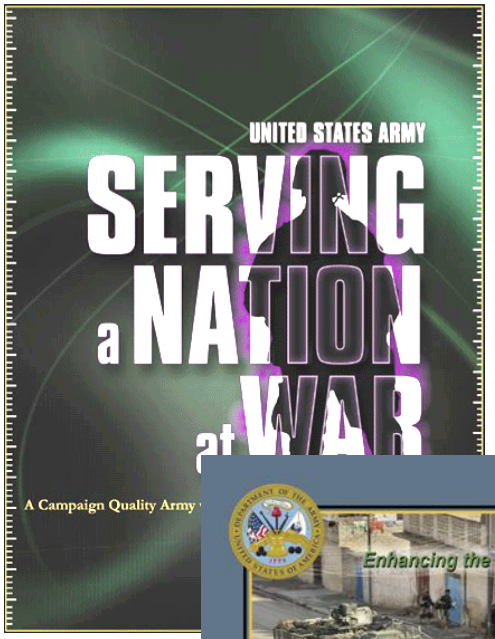
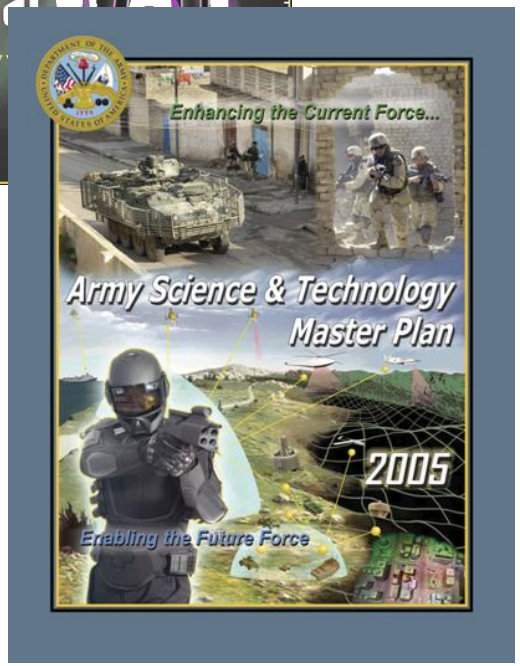




Army Science & Technology

NDIA
Army S&T Challenges for Current and Future Forces
April 19, 2006

Mary J. Miller
Director for Technology
Office of the Assistant Secretary
for Research & Technology

Purpose

Provide an overview of the Army's S&T program challenge to develop technologies that will enhance the Current Force while concurrently enabling the Future Force

Outline

- *Army S&T Overview*
  - *Vision*
  - *Strategy*
  - *Warfighter is our Customer*
- *Army Investment*
- *Support to Future Force*
- *Basic Research*
- *Manufacturing Technologies*

Capabilities for a Joint and Expeditionary Army

Current Force

~100 lb. load

70+ tons

< 10 mph

Enabling the Future Force

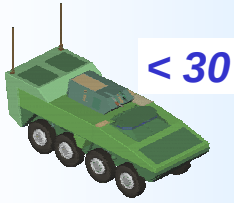
Science and Technology—develop and mature technology to enable transformational capabilities for the Future Modular Force while seeking opportunities to accelerate technology directly into the Current Modular Force

Enhancing the Current Force

Future Force

< 40 lb. load

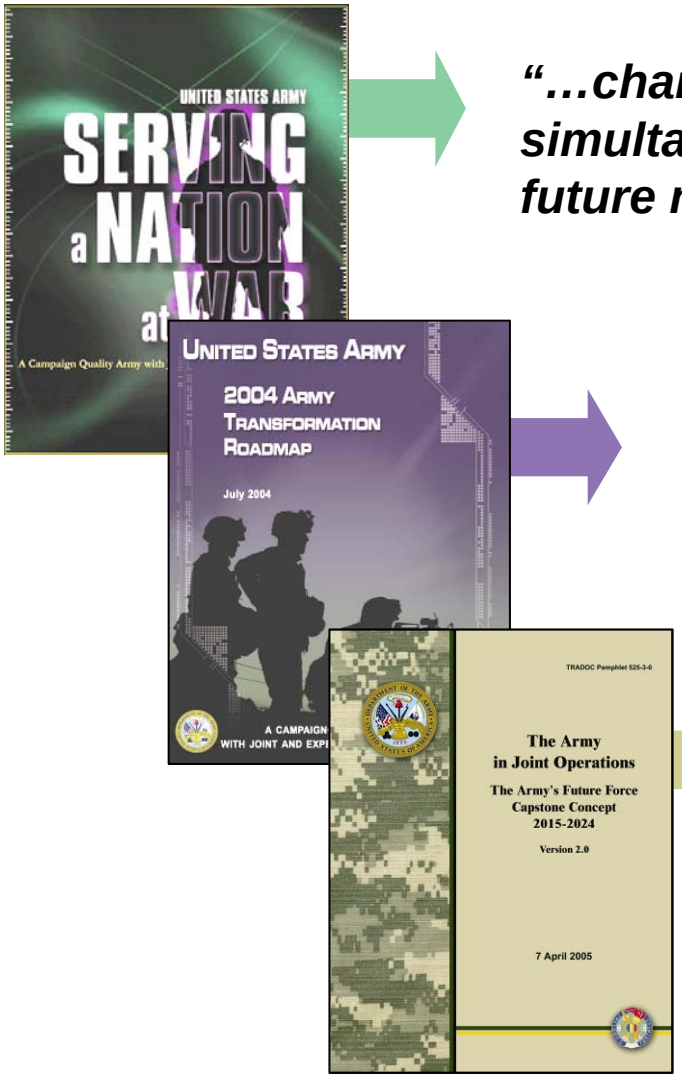
Fully networked



< 30 tons

> 40 mph

Army Strategies

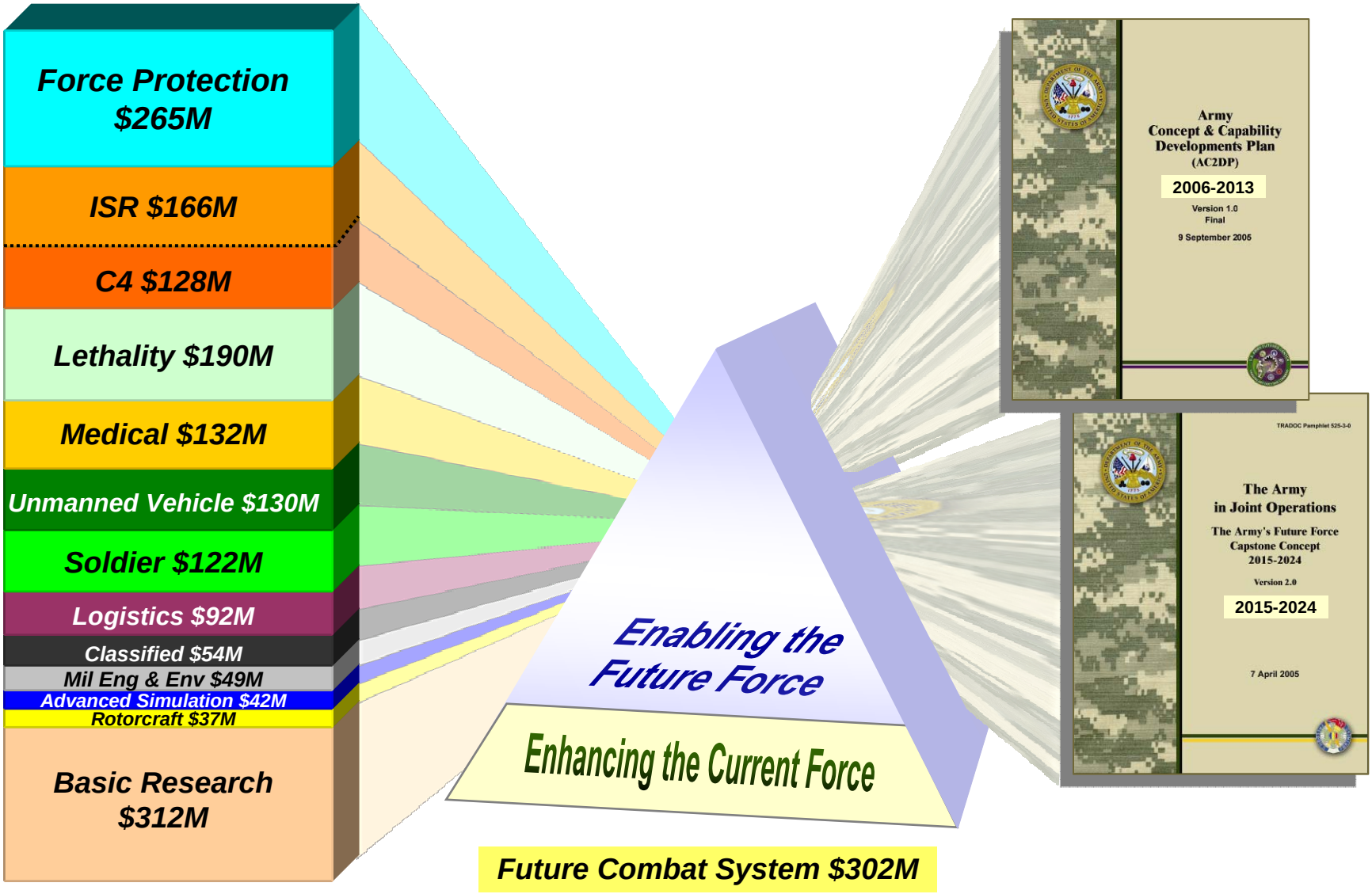


"…change in time of war must deal simultaneously with both current and future needs"

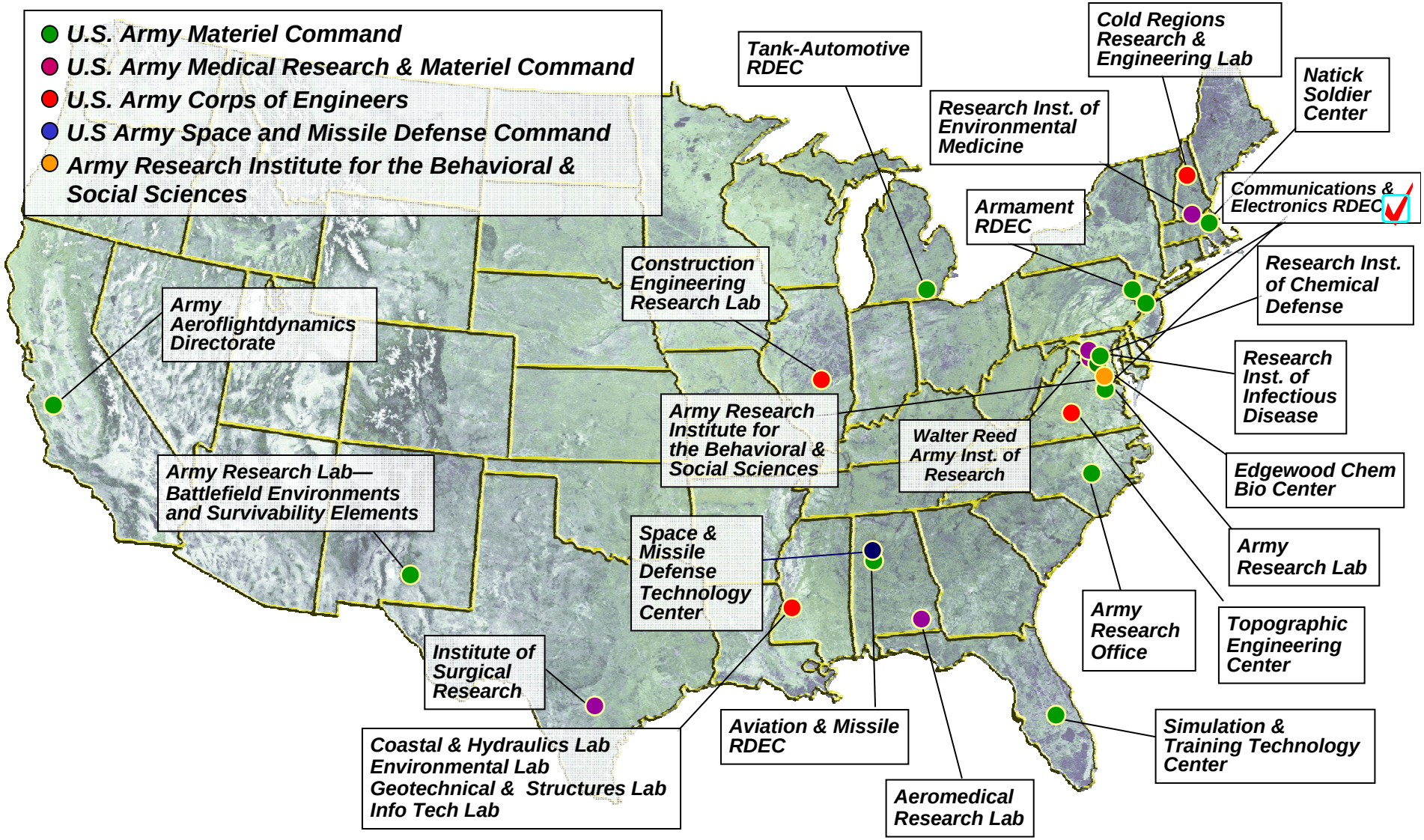
"…provide dominant land power to the Joint Force now and into the future."

"The FCS further encompasses a set of technologies and capabilities that will spiral into the entire Army as they mature. Networked C4ISR, precision munitions, and advanced fire control will also be key enablers."

Technology Area Investment
FY07 $1.7B

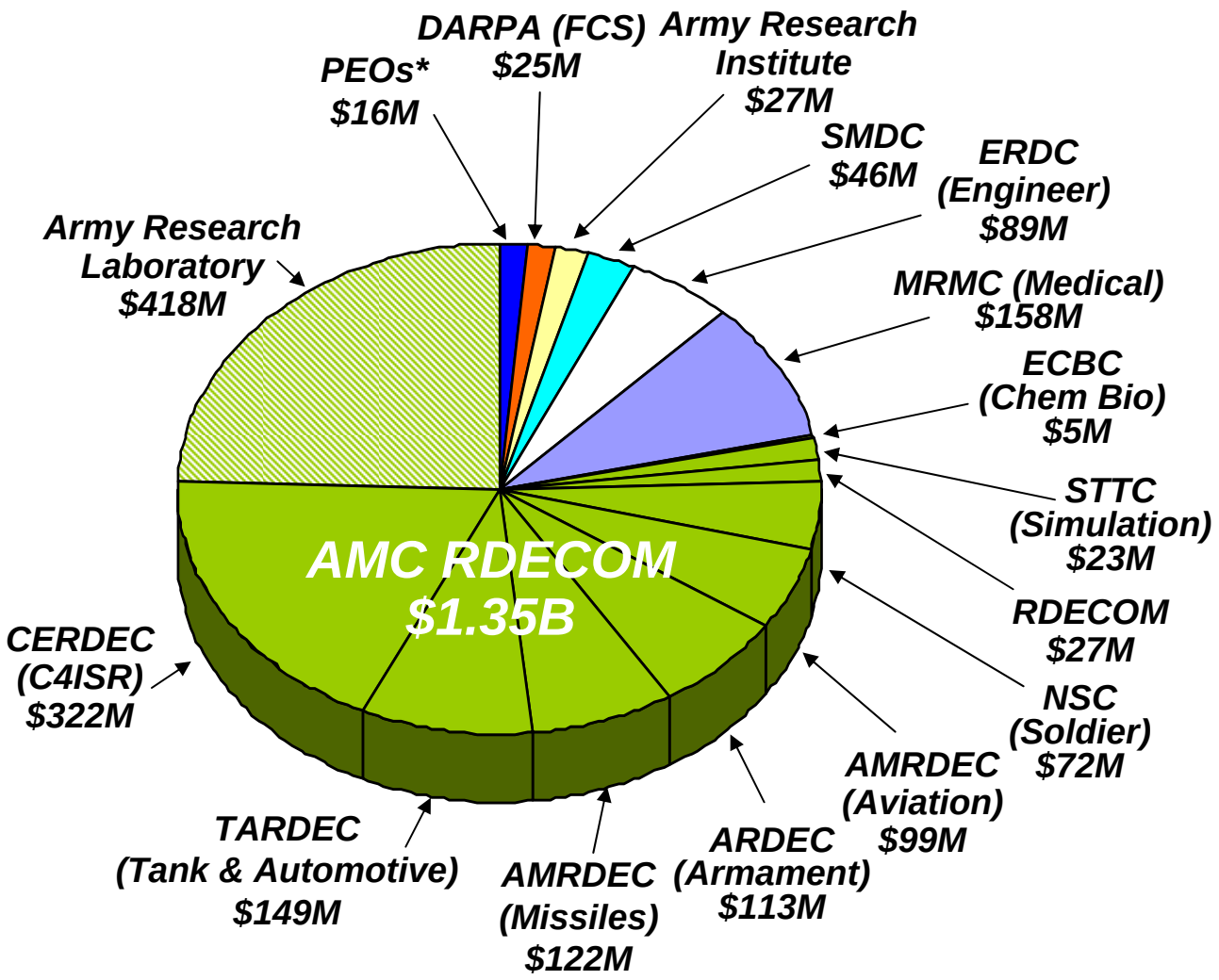


Army Research, Development & Engineering Centers and Laboratories



FY07 Army S&T Investment Perspective

Lab	FY07
Army Research Lab	$418M
CERDEC (C4ISR)	$322M
MRMC (Medical)	$158M
TARDEC (Tank & Automotive)	$149M
AMRDEC (Missiles)	$122M
ARDEC (Armament)	$113M
AMRDEC (Aviation)	$99M
ERDC (Engineer)	$89M
NSC (Soldier)	$72M
SMDC	$46M
Army Research Institute	$27M
RDECOM	$27M
DARPA (FCS)	$25M
STTC	$23M
PEOs*	$23M
ECBC	$5M
FY07 S&T Total	$1.7B



*PEO-Ammo ($10M, OSD devolved)
PEO-IEW (2 ACTDs)

3 Different Types of S&T Investments

Basic Research, Applied Research, Advanced Technology Development

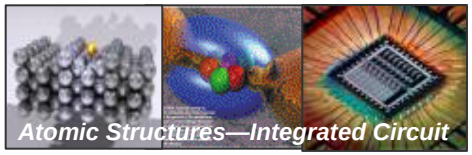
S&T FY07 $1.7B

Development → Acquisition

6.1: Basic Research $312M (18% of S&T—5% OSD Directed)

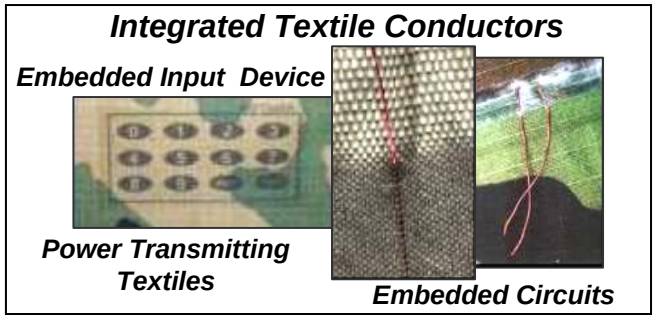
Physics-Based Modeling

Quantum Computing



- ***<u>Understanding</u> to solve Army-unique problems***
- ***<u>Knowledge</u> for an uncertain future***

6.2: Applied Research $685M (40% of S&T)



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

6.3: Advanced Technology Development $722M (42% of S&T)

Flight Demonstration

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

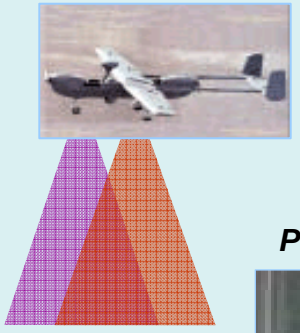
ATO-Rs—Army Technology Objectives—ATO-Ds

Far Term → Mid Term → Near Term

Future Force—Force Protection

Counter IED

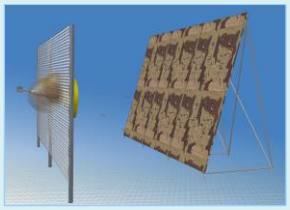
Sensors for Explosive Detection



Airborne IED Detection

Ground Penetrating Radar

Counter Rocket Artillery Mortar



Modular Protective Systems for structures

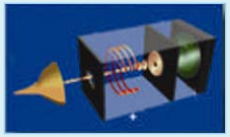
Solid State Laser (SSL) Technology

Platform Protection

Kinetic Energy Active Protection

Integrated Rotorcraft Protection

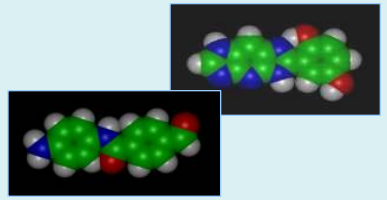
Structural Armor



Electromagnetic Armor

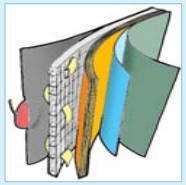
Soldier Protection

Protect (Integrated Suit & Helmet)



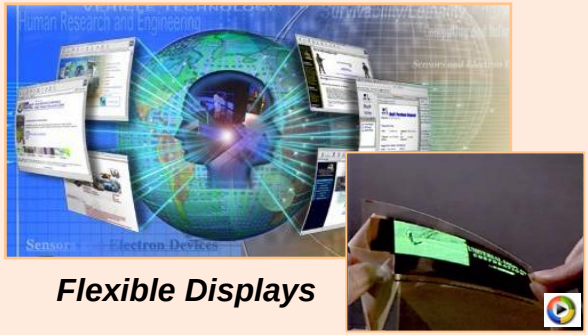
Advanced Fiber Technology for Ballistic Protection

Nanomaterials for Ballistic Protection



Future Force—ISR and C4

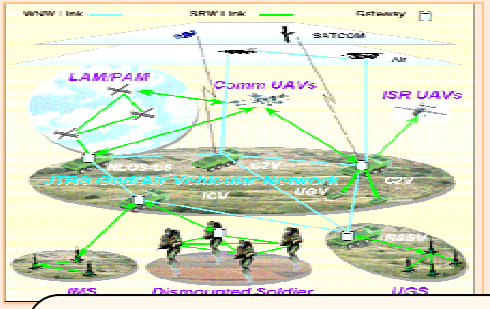
Command & Control



Flexible Displays

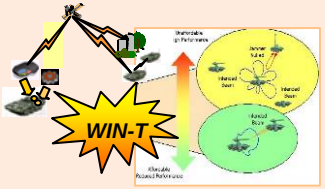
Knowledge Fusion

Tactical Mobile Networks



Advanced Antennas

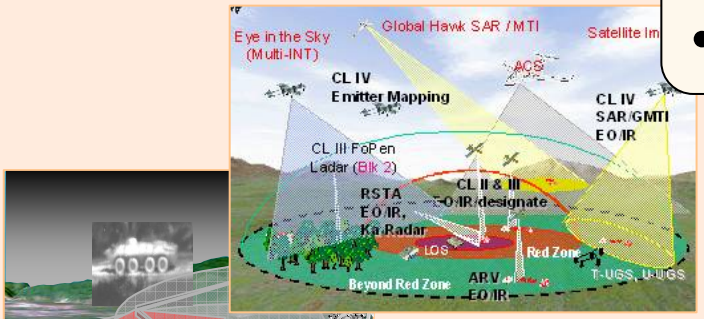
Tactical Network & Communications Antennas



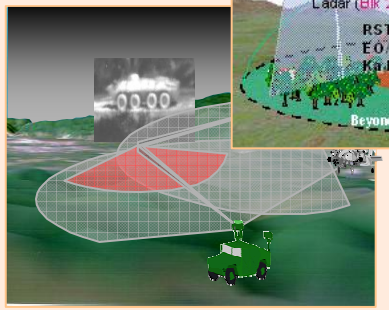
Directional Antennas

- Find the Enemy
- Assured Comms
- Battle Command

Persistent Sensor Coverage



Unblinking "Eye"

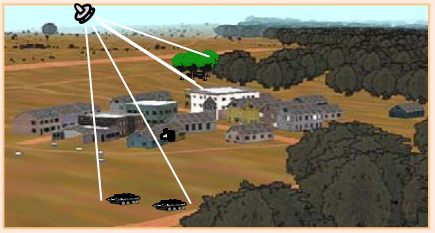


3rd Gen Infrared Sensors

MOUT Situational Awareness

Through Wall Sensing

C2 in Complex & Urban Terrain



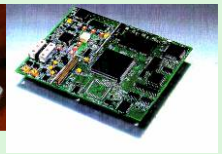
Unmanned Aerial Vehicle (UAV) Sensor Mission Equipment Packages

Future Force—Lethality

Missiles

Control Actuators

IMU
Guidance & Control



GPS
Receiver

Future Missile Technology

Next Gen NLOS-LS and C3

Smaller, Lighter, Cheaper (SLC) Missiles

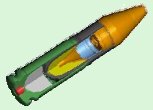
- Precision/ Maneuverable Urban Weapons
- Lighter/ Cheaper Manportable

Loitering Attack Missile (30-60 min)

Precision Attack Missile (>40km)

Joint Small Arms

Armor Piercing Munitions

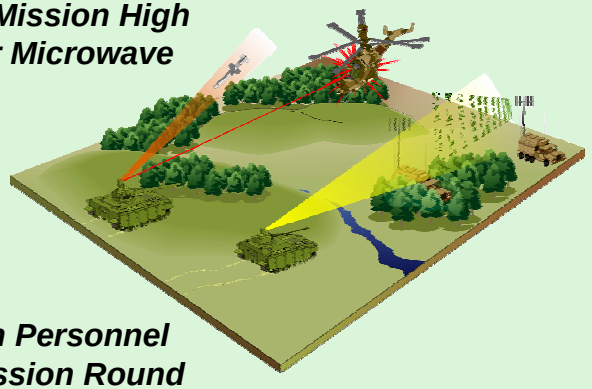


Lightweight Machine Gun

Caseless Ammo

Non Lethal

Multi-Mission High Power Microwave



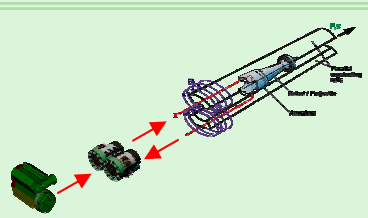
155mm Personnel Suppression Round (Malodorants)

Ultra-short Pulsed Lasers

Guns and Munitions

Multi-mission Capability from a Single Platform

Electromagnetic Gun… paradigm shift in propulsion



Mid Range Munition

LOS MP

Advanced KE

Future Force—Medical

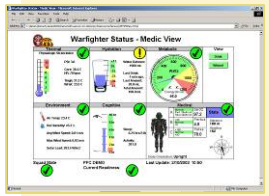
Combat Casualty Care

- Self Contained Life Support System for Stabilization & Transport
- Optimal use of Resuscitation Fluids

Advanced Combat Casualty Litter System

Fluid Resuscitation Technology

Operational Medicine



Remote Health Monitoring & Assessment

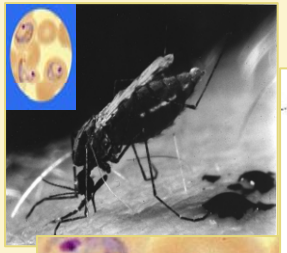
Physiological Status Monitoring

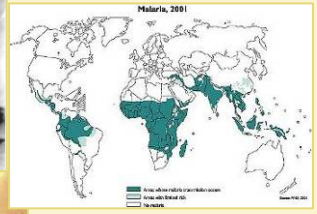
Diagnostics to Determine Soldier Exposure to Industrial Chemicals/ Materials

Indicators of Toxic Exposure

Drug/Vaccine Development

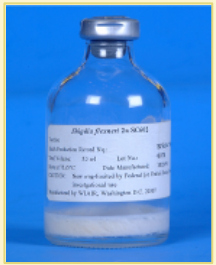
Infectious Disease





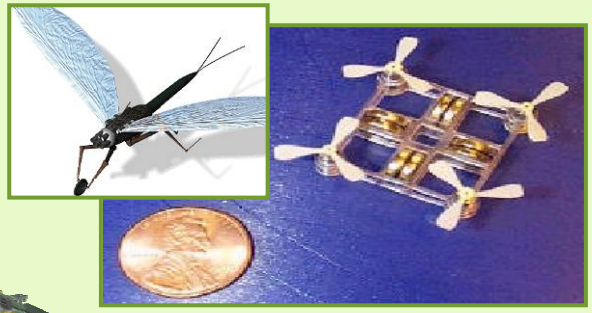
Prevention & Treatment of Malaria

- Vaccines to Prevent Diarrhea due to Campylobacter & Shigellosis
- Scrub Typhus Vaccine
- Sand Fly Control Preventive Medicine System
- Research into Hantaviruses & Hemorrhagic Fever



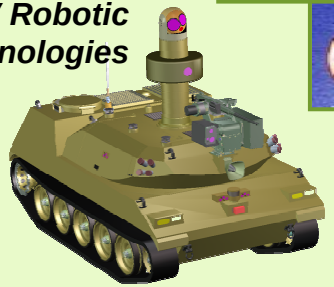
Future Force—Unmanned Systems

Near Autonomous Unmanned Technologies

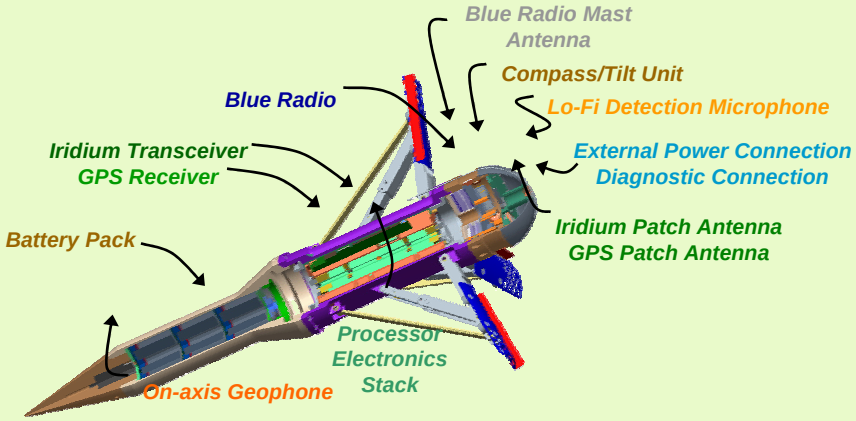


Micro Air Vehicles

ARV Robotic Technologies



Unattended Sensors



Sensor Dart

Unmanned Air Vehicles

A-160 Hummingbird

Extended Range & Increased Payload

Organic Air Vehicle (OAV)

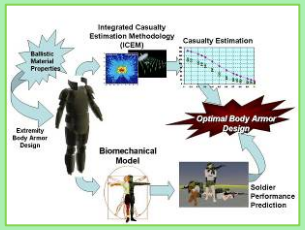
Extended Range & Endurance

Micro Air Vehicle (MAV)

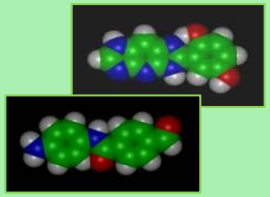
Extended Loiter "Perch & Stare"

Soldier Systems

Survivability

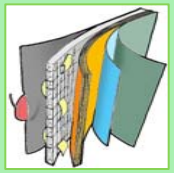


Modeling & Simulation



Advanced Fiber Technology for Ballistic Protection

Nanomaterials for Ballistic, Laser, Environmental Protection



Rations

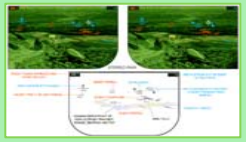
Biosensor Technology for Food Safety

First Strike Compact Ration

Future Force Warrior

Fused Thermal/ I2 Imagery

Protect (Integrated Suit & Helmet)



Collaborative Networked Situational Awareness

Robotics Interface

Strike (Exploit FCS Netted Fires)

Embedded Training

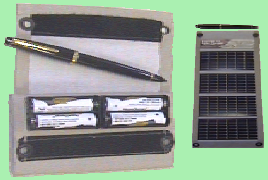
Advanced Power Sources

Power

Fuel Cell Battery Hybrid

Stirling Engine

Photovoltaics & Electro-textiles



Sensors

Physiological Status Monitoring

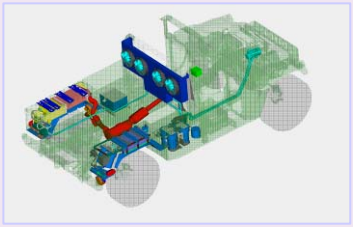
Uncooled IR Sensors for UAVs

Pointer

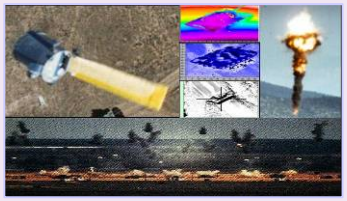
Future Force—Logistics

Sustainment

Water Generation & Recovery



EM Gun Munitions



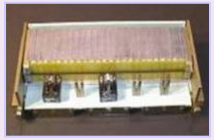
Common Smart Submunitions

Deployability

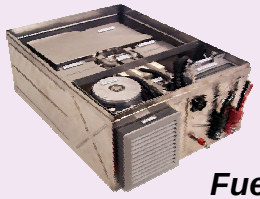
Joint Rapid Airfield Construction

Joint Heavy Lift

Power & Energy



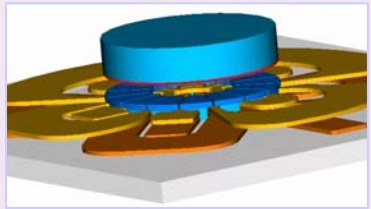
Hybrid Electric Drive



Fuel Reformation

Heavy Fuel Engine

Battery State of Charge Indicator



Portable Compact Power

Future Force—
Advanced Simulation/Personnel Technology

Training Simulation

Training Methods & Measures for Better Decision-making & Information Use

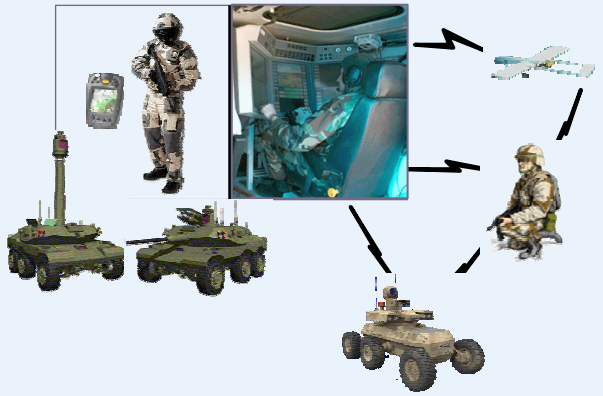
Training Future Force Small Unit Leaders & Teams

Embedded Combined Arms Team Training & Mission Rehearsal

Adaptive Learning Environments

Personnel Technology

Strategies to Enhance Retention

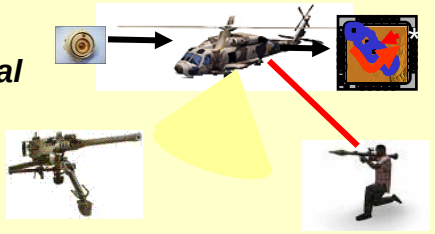


Human-robotic Interfaces

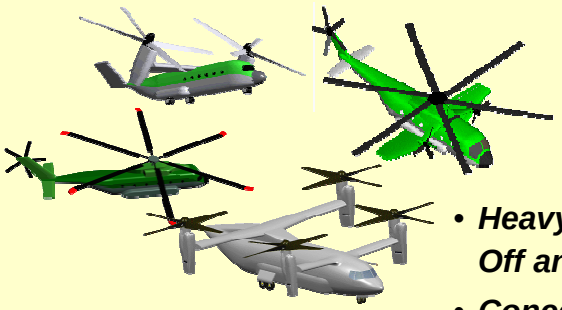
Future Force—Rotorcraft

Survivability

- *Materials & Structures for Reduced IR Signature*
- *Adaptive Engine IR Suppression*
- *Super-lightweight Thermal Insulation*
- *EO/IR Countermeasures*
- *Hostile Fire Warning & Visual Cueing*
- *Affordable Directional IR Jamming*



Joint Heavy Lift

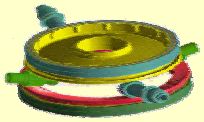


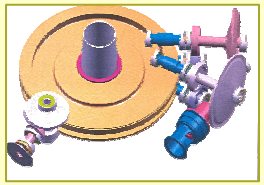
Technical Feasibility

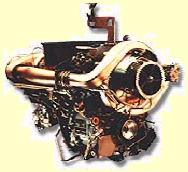
- *Heavy Lift Vertical Take Off and Landing*
- *Concept Refinement*
- *5 Contractor Teams*
- *Requirements Generation and Analysis*

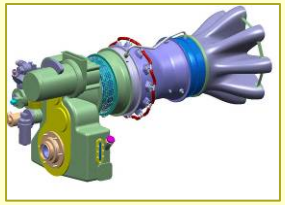
Engines & Drive Trains

- *Lighter Weight Components*
- *Increased Reliability*
- *Increased Fuel Efficiency*
- *Reduced Cost*
- *Reduced Vibration*



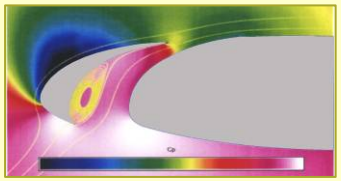






Rotors & Flight Controls

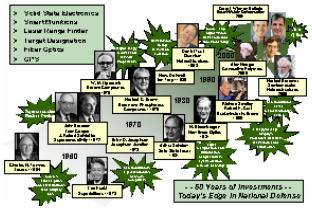
- *Hybrid Rotor*
- *Optimum Speed Rotor Evaluation*
- *Reduced Weight/ Vibration*
- *Reduced O&S*
- *Intelligent & Active Controls*
- *Improved Reliability and Durability*



Basic Research

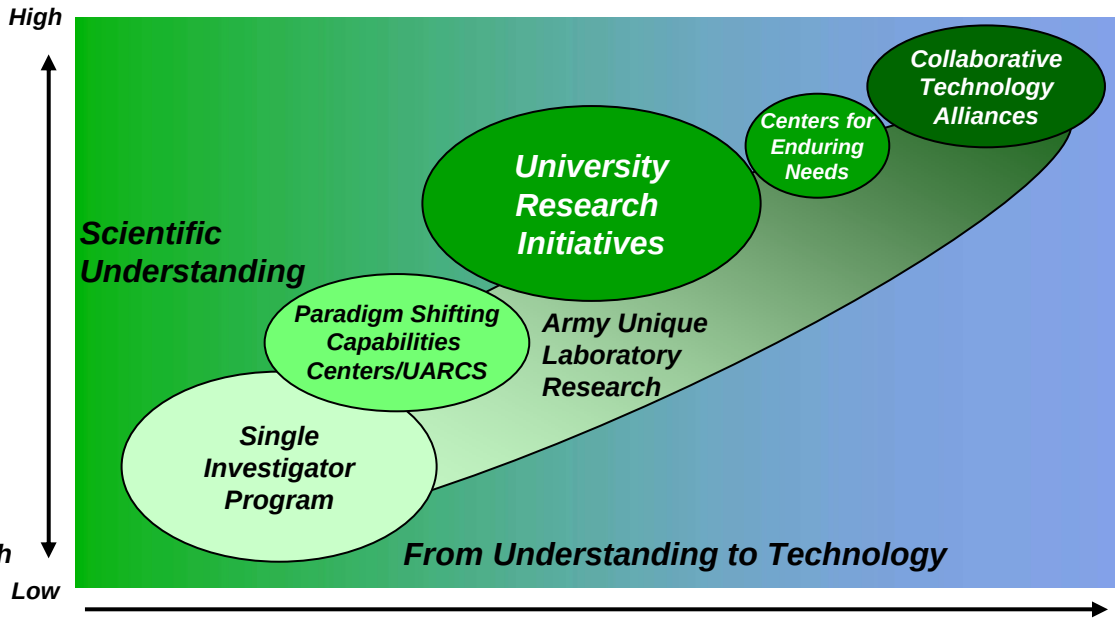
University Single Investor Program

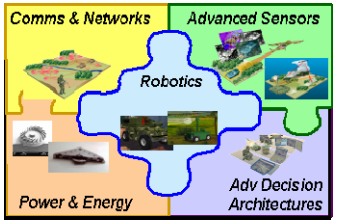
- Solid State Physics
- Structural Mechanics
- Electro-magnetics
- Materials Science
- Innovative Countermine



University Research Initiative (Devolved)

- Multidisciplinary Research
- DURIP

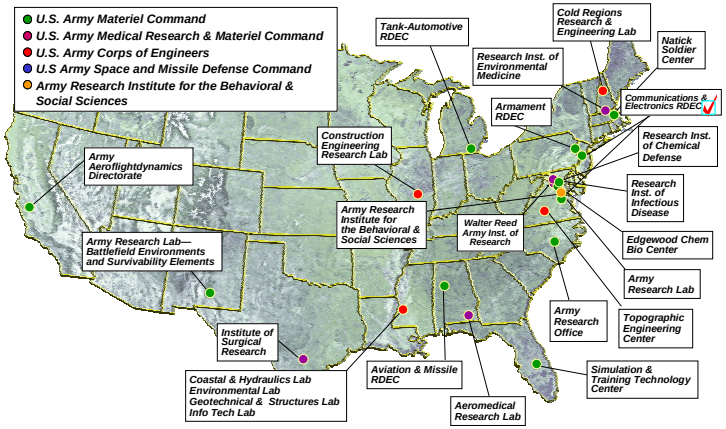




Collaborative Technology Alliances

- Comms & Networks
- Robotics
- Advanced Sensors
- Power & Energy
- Advanced Decision Arch
- Network & Info Science ITA

In- House Research



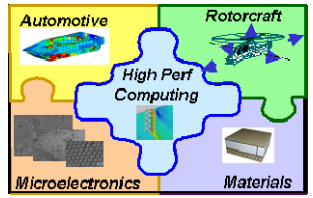
Paradigm Shifting Capabilities Centers/ UARCs

Institute for Advanced Technologies

Institute for Soldier Nanotechnologies

Institute for Collaborative Biotechnologies

Institute for Creative Technologies



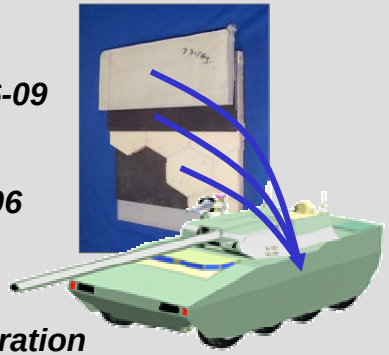
University Centers for Enduring Needs

- Microelectronics Center
- Vertical Lift Center of Excellence
- Materials Center
- Automotive Research Center
- High Perf Computing
- HBCU/MIs with Battle Labs

Manufacturing Technology

Armor

- Low-cost Composites FY06-09
- Appliqué Armor FY07-09
- Low Cost Titanium Mfg FY06

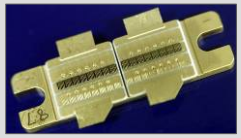


Composite Structural
& Appliqué Armor Integration

Electronics/Power Systems

- S/W Radios FY06-09
- Silicon Carbide Switches FY06-09
- Phase Shifter FY06-08
- Power Storage Systems FY06-09

Li-Ion Cell



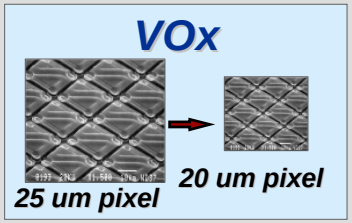
SiC Gate-drive
Module

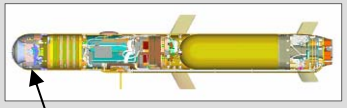
Common SDR Core
Transceiver

Sensors

- Dual Band FPA Cooled FY06
- Flexible Display FY06-09
- Uncooled FPA FY06

Flexible Display Initiative



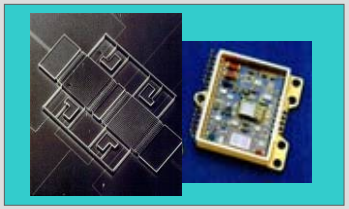


Raytheon
PAM Demonstrator

Uncooled Infrared

Munitions

- MEMS-IMU/GPS FY06-07
- MEMS Safe & Arm FY06-07
- Durable Gun Barrels & Armaments FY06-06

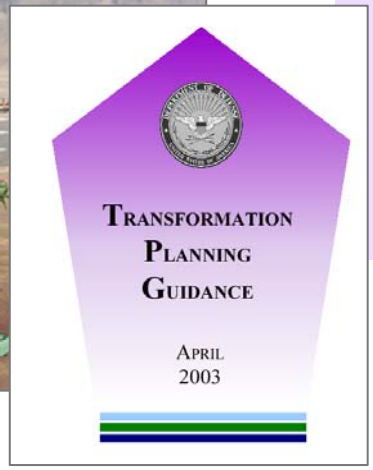


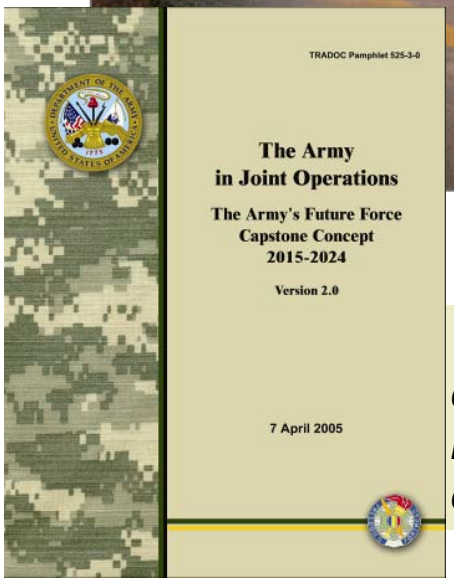
MEMS-IMU

155mm NLOS Cannon

Lightweight 120mm Gun

The Army…
Transforming while at War





"…this may mean making the difficult decision of foregoing currently planned systems and investing instead in capabilities that we believe will reduce future risk."

Secretary Rumsfeld

"The FCS further encompasses a set of technologies and capabilities that will spiral into the entire Army as they mature. Networked C4ISR, precision munitions, and advanced fire control will also be key enablers."