Army Science & Technology Overview

4 Apr 2007

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Outline

- ***Science and Technology (S&T) Strategy***
- ***Warfighter Guidance and Drivers***
- ***Technology Area Investments***

Science & Technology for a Campaign Quality Army with Joint & Expeditionary Capabilities

Current Force

~100 lb. load

Limited network

> 70 tons

< 10 mph

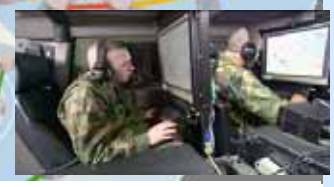
Enabling the Future Force

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

Enhancing the Current Force

Future Force

< 40 lb. load



Fully networked

< 30 tons

> 40 mph

From Science to Technologies…Systems

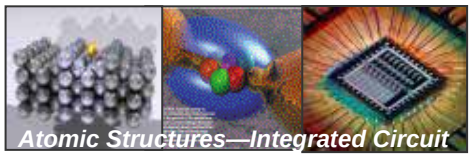
3 Different Types of S&T Investments

S&T PB08 $1.7B

Development → **Acquisition**

6.1: Basic Research 18% of S&T

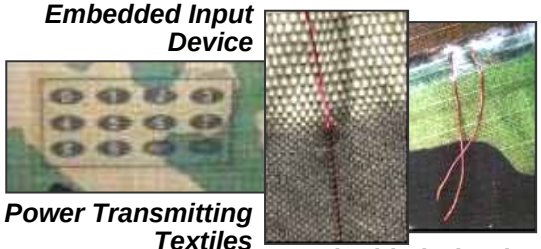
Nanoscience



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

6.2: Applied Research 40% of S&T

Integrated Textile Conductors



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

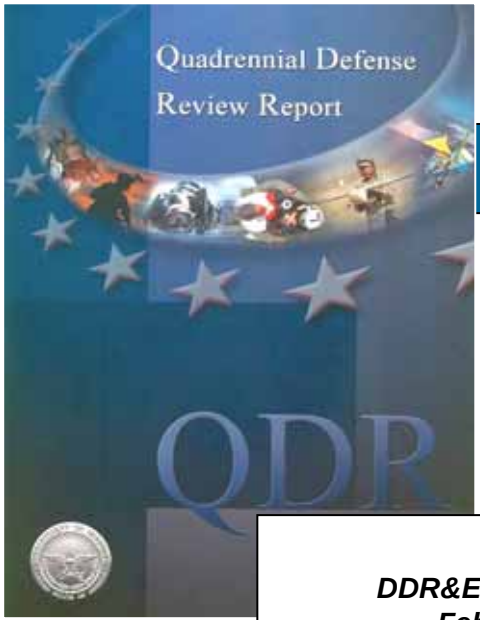
6.3: Advanced Technology Development 42% of S&T

Precision Air Drop— 50 meters

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

Far Term | **Mid Term** | **Near Term**

OSD Planning Framework

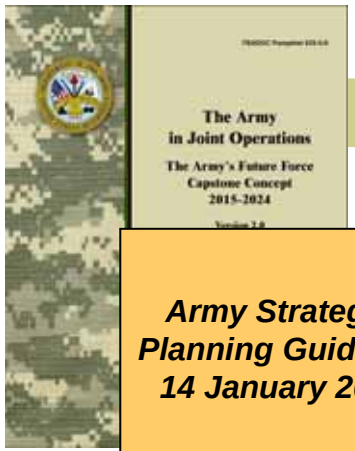


Enhance our expeditionary combat power and shape the Services to be lighter, yet more lethal, more sustainable and more agile

DDR&E Guidance
Feb 2006

Protection, Battlespace Awareness, Force Application, Focused Logistics—implementing QDR guidance

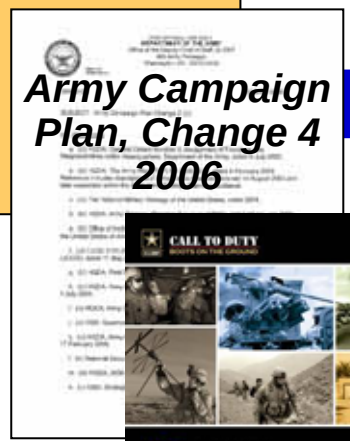
Army Level Guidance



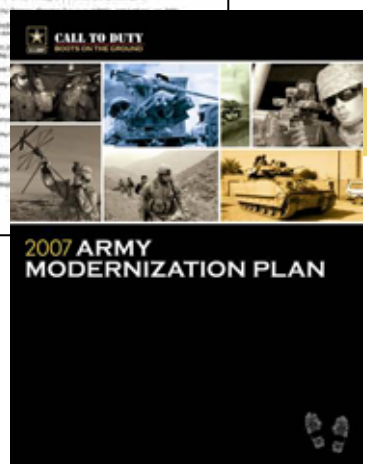
"The FCS further encompasses a set of technologies and capabilities that will spiral into the entire Army as they mature. Networked C4ISR, precision munitions, and advanced fire control will also be key enablers."

Army Strategic Planning Guidance 14 January 2005

"…provide relevant and ready land power capability to the Combatant Commander as part of the Joint Team"



"… provide relevant and ready land power to combatant commanders and the Joint Force..."



"The Army's investment strategy pursues technologies to achieve the goal to field forces that are "lighter yet more lethal, more sustainable and more agile" while achieving entirely new capabilities..."

TRADOC Capability Gaps—Shaping S&T Programs

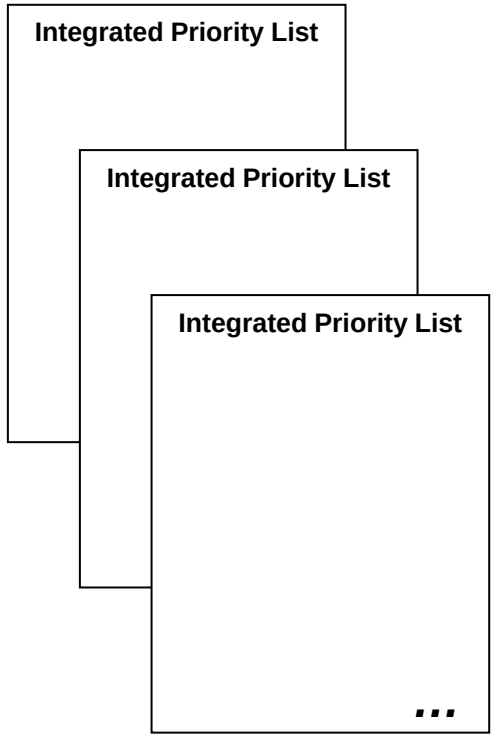
Emerging Top Challenges for Current Force 2006

- Networked Enabled Battle Command
- Protect Force in Counterinsurgency Operations
- Soldier Protection in Counterinsurgency Environme
- Logistics and Medical in Counterinsurgency Operati non contiguous battlespace
- Train the Force How and As it Fights
- Tactical Communications
- Ability to Conduct Joint Urban Operations
- Joint Interoperability, Coalition and Interagency Ope
- Enhanced ISR Capabilities
- Timeliness of Analysis, and Information Disseminati

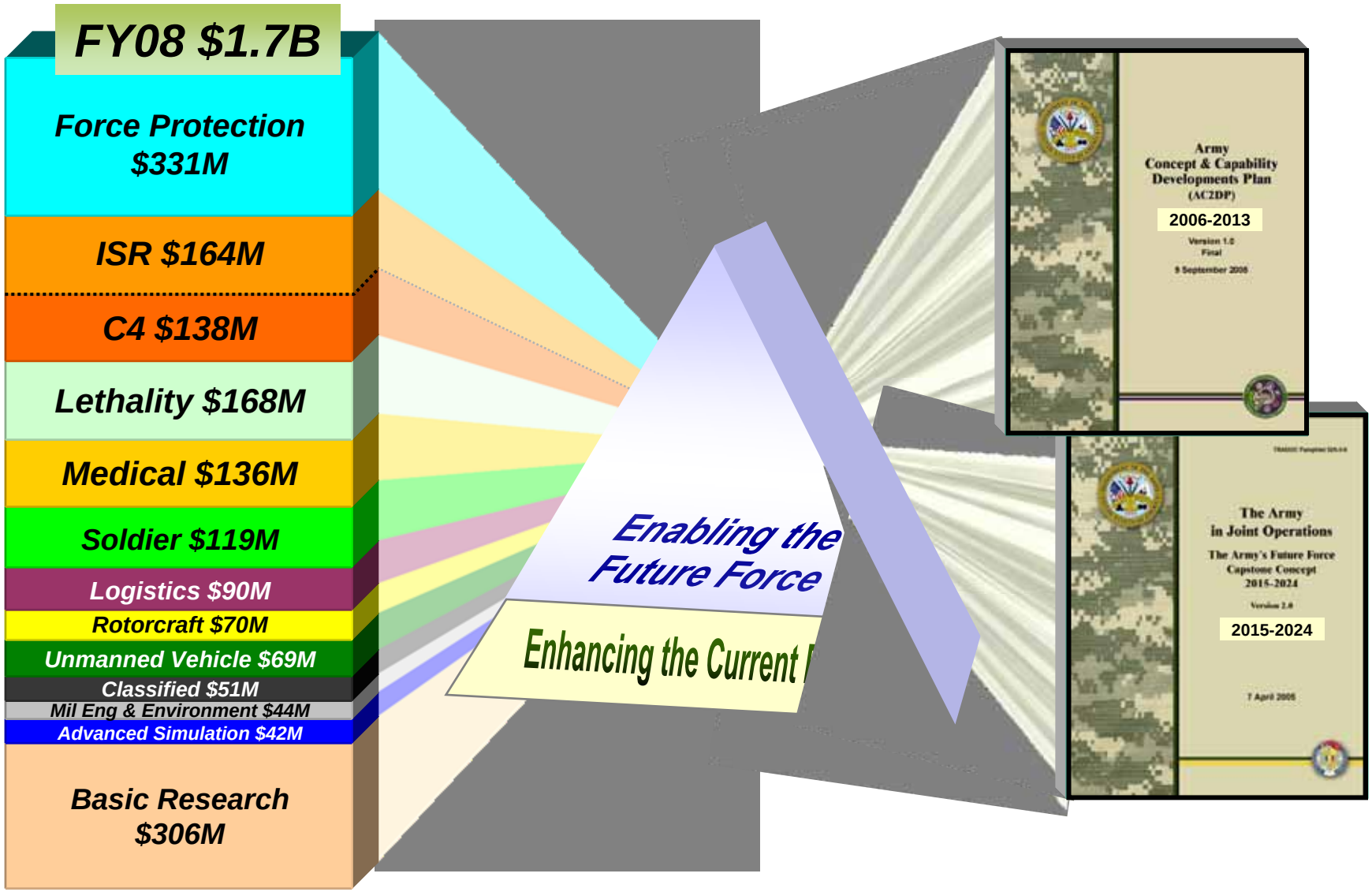
Future Force Capability Gap Areas

- Enhanced Soldier Protection
- Modular, Scalable and Tailorable Battle Command and Control
- Enhance Platform/Group Protection
- Dynamic, Uninterrupted Communications Network
- Sustainment of Modular Forces
- Enhanced Collection, Exploitation and Dissemination
- Strategic Force Projection/Intratheater Operational Maneuver and Sustainment
- Modular, Tailorable Forces
- Capability for Lethal/Non-lethal Overmatch
- Ability to Train the Force How and As it Fights

Responding to Joint Needs



Technology Area Investments to Satisfy Gaps—New Capabilities

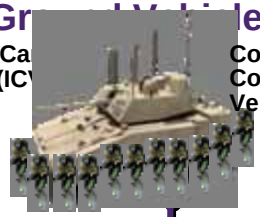


FCS Brigade Combat Team

PROGRAM MANAGER FCS BRIGADE COMBAT TEAM
One Team-The Army/Defense Industry

Manned Gr[illegible]les (MGV

Infantry Ca[illegible]
Vehicle (ICV



Command an[illegible]
Control
Vehicle (C2V)

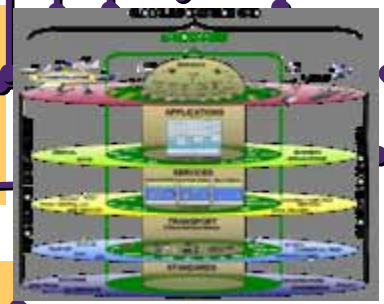
Mounted Combat

Reconnaiss[illegible]
And Survei[illegible]
Vehicle (RS[illegible]

Unmanned Aerial Systems (UAS)

Class I UAV

Class IV UAV



Unattended Ground Systems (UGS)

T-UGS

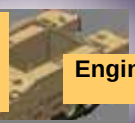
U-UGS

Tactical and Urban
Unattended
Ground Sensors

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

Common Chassis

Advanced
Lightweight
Armor



Engine

Non-Line of
Sight Mortar
(NL[illegible]

Unmanned Ground Vehicles (UGV)

Multifunction Utility/
Logistics
and Equipment
Countermine and
Transport

Small UGV (SUGV)

Armed Robotic
Vehicle – Assault
(Light) (ARV-A-L)

Medical Vehicle
Trea[illegible]

[illegible]icle
(MV-E)

FCS Recovery and
Maintenance
Vehicle (FRMV)

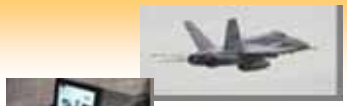
Support to Current Operations

Demonstrations, Prototypes, or Limited Fieldings

Countermine/ Counter Boobytrap

WARLOCK Jammers

Explosive Detection

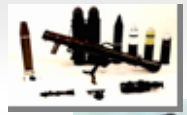


Change Detection Workstation

Enhanced Lethality

Acoustic Gunfire Detection System

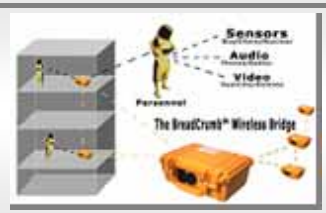
SWORDS



Special Purpose Munitions

Network

Well Camera



Secure Wireless Relays

Satellite Nodes

Power & Energy

Zinc-Air Battery Family

"AA" Battery Solar Charger

SATCOM & Javelin Hybrid Power Sources

Survivability

Integrated Rocket, Artillery, Mortar (RAM) Detection

Backstop

Current Force—Force Protection

Platform Protection


Stryker w/Bar Armor


Tactical Vehicle Add-on Armor


Deltoid Axillary Protection


Interceptor Body Armor


Vehicle Class Body Armor Support System


Expedient HMMWV Armor Kit


Tear-off Windshields


SAPI Plates

Counter Rocket Artillery Mortar


Unattended Transient Acoustic MASINT System (UTAMS)


Backstop


Lightweight Counter Mortar Radar

Countermine/Counter Boobytrap

Detection, Surveillance, Neutralization and Defeat


Airborne Detection


Neutralization


Robotic Detection/Neutralization

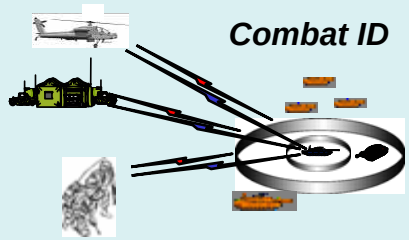
Future Force—Force Protection

Platform Protection

Structural Armor

Laser Vision Protection

Active Protection



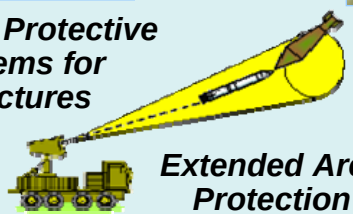
Combat ID

Integrated Rotorcraft Protection

Counter Rocket Artillery Mortar

Modular Protective Systems for structures

Solid State Laser (SSL) Weapon System Concept



Extended Area Protection

Countermine/Counter Boobytrap

Detection, Surveillance, Neutralizatio and Defeat

Networked Electronic Warfare

Packbot w/ sensor

Concealed Explosives Detection

Current Force—ISR and C4

Command & Control

Urban Tactical Planner (UTP)

Agile Commander

Networked Comms

Airborne Network Extension

Tele-engineering

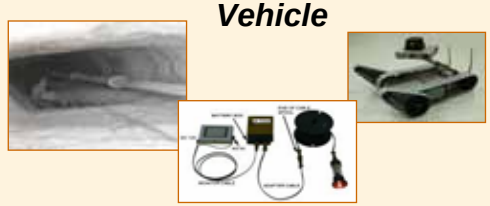
Integrated Meteorological System

Extended Range Communications (Breadcrumb)

Surveillance & Sensors

Overwatch—Detection & Classification of Hostile Fire

Well Camera & Remote Robotic Vehicle



Mobile Stabilized Panoramic Sight

IR Sensors for Small Raven & Pointer

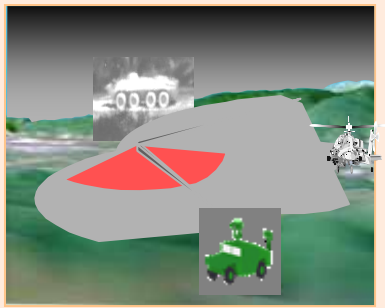
Wide Field of View Night Vision Goggle

Pilar Gunfire Detection System

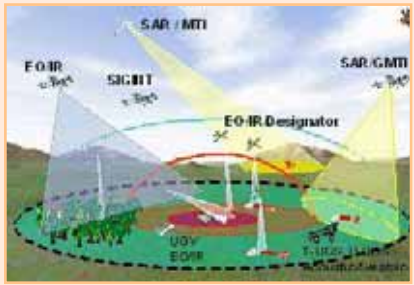
Future Force—ISR and C4

ISR
C4

Persistent Sensor Coverage



3rd Gen Infrared Sensors



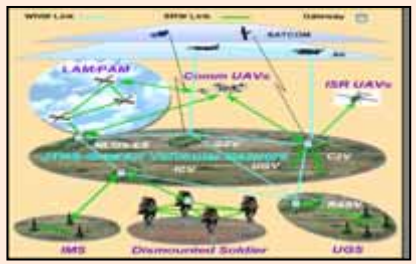
Layered Networked Sensors

Command & Control

Knowledge Fusion

Flexible Displays

Tactical Mobile Networks



- Find the Enemy
- Assured Comms
- Battle Command

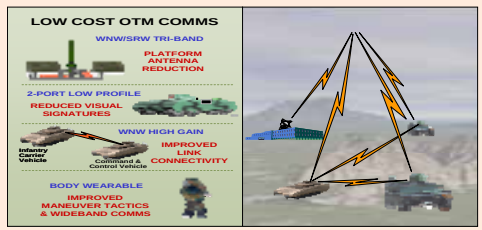
MOUT/Situational Awareness

Through Wall Sensing

C2 in Urban Terrain

Pos/Nav Network Assisted and Improved MEMS IMUs

Advanced Antennas



Tactical Network & Communications Antennas

Directional Antennas

Future Force—Medical

Medical

Combat Casualty Care

Improved Treatment for Head Injuries

Regenerative Therapies

Far-Forward Resuscitation & Hemorrhage Control

Semi-Autonomous Intensive Care & Transport System

Infectious Diseases

Malaria Treatment Drugs

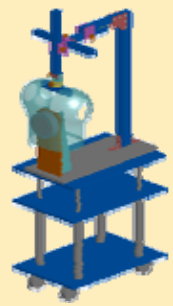
Malaria Prevention Vaccines

Malaria Rapid Diagnostic Device

Dengue Prevention Vaccines

Operational Medicine

Remote Monitoring of Warfighter Health and Performance



Performance Test for Future Lightweight Body Armor Systems

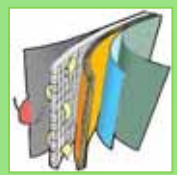
Future Force—Soldier Systems

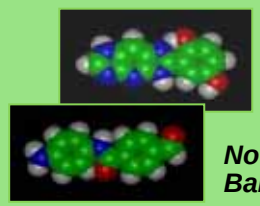
Soldier

Survivability

Modeling & Simulation

Nanomaterials for Ballistic, Laser, Environmental Protection





Novel Fibers for Ballistic Protection

Future Force Warrior

Rations

First Strike Compact Ration

Biosensor for Food Safety

Joint Combat Feeding

Power

Fuel Cell Battery Hybrid

Photovoltaics

Stirling Engine

Electro-textiles

Personnel Technologies

Accessing, Retaining & Training Adaptive Soldiers & Leaders

Realistic, Effective Training

Sensors

Physiological Status Monitoring

Uncooled IR Sensors for UAVs

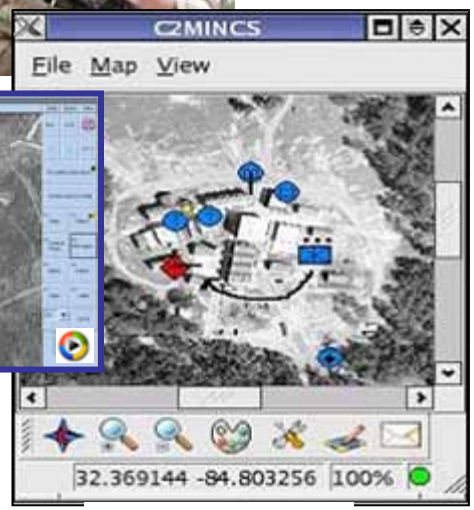
Pointer

Future Force Warrior (FFW)—2006

- *FFW Increment 1 at C4ISR OTM Jun-Aug 06:*
  - *Integration into Future Force network via Soldier Radio Waveform*
  - *Current force integration via FBCB2*
  - *Integrated combat ensemble with stand-off body armor/load carriage/electronics and signature management*
  - *Squad level NLOS cooperative engagement*
  - *Headgear with integrated fused thermal and I2*
  - *System voice control*
- *FFW Early Increment 2 improvements at OTM 06 and AAEF/Spiral C:*
  - *Beyond squad level NLOS cooperative engagement*
  - *Digital target hand-off to joint platforms (F-16, A-10)*
  - *Class I UAV imagery feed*
  - *Goggle mounted "look down" display*
  - *Physiological status monitoring*
- *FFW at C4ISR OTM and AAEF/D in 2007*
  - *Precise positioning system*
  - *Low power flexible display demo*
  - *Headgear sensor fusion*
  - *Wireless Personal Area Network and weapons interface*
  - *UGV, UGS integration to FFW platform*
  - *Compact computer (Falcon computer from AFRL)*
  - *Apache digital target hand-off*

DARPA

Leader Display



Soldier Display

FFW transitions to PEO Soldier in 1QFY08 for Ground Soldier System (next generation Land Warrior)

Future Force—Logistics

Logistics

Power & Energy

Hybrid Electric Drive

Heavy Fuel Engine

Fuel ormation

Fuel Cell Development

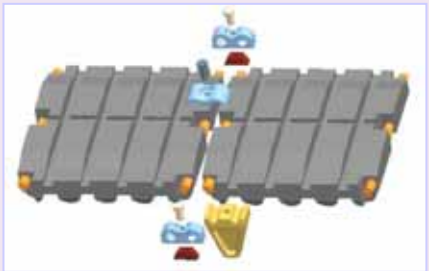
UNITED STATES ARMY NAC NATIONAL AUTOMOTIVE CENTER

Utility Variant

Sustainment Variant

Future Tactical Truck System Concepts

Deployability

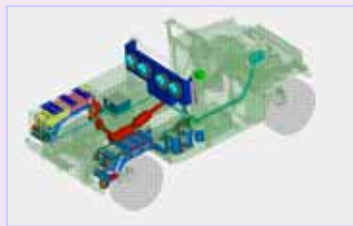


Lightweight Band Track

Precision Air Drop 30k lbs

Sustainment

Water Generation & Recovery



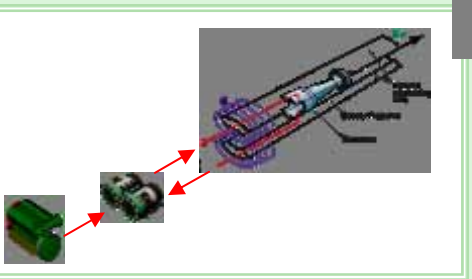
EM Gun Munitions

Prognostics/ Diagnostics

Future Force—Lethality

Guns and Munitions

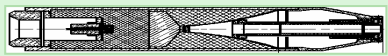
Electromagnetic Gun… paradigm shift in propulsion



Electronically Controlled Variable Effects Warheads

Wall Breaching Munitions

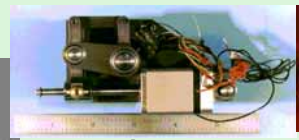
Small Arms Deployable Sensor Network



Urban Assault Munitions

Missiles

GPS Receiver



Control Actuators

IMU

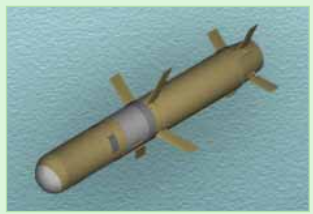
Guidance & Control

Future Missile Technology

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

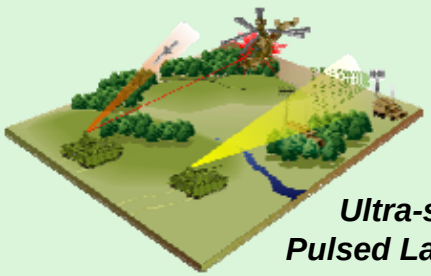
NLOS-LS and C3

Precision Attack Missile (>40km)



Non-lethal

Multi-Mission High Power Microwave

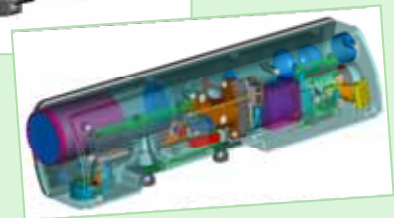


Ultra-short Pulsed Lasers

Joint Small Arms

Lightweight Weapon Component Technologies

Lightweight Caseless Ammo



Target Acquisition Fire Control Sub-system

Future Force—Rotorcraft

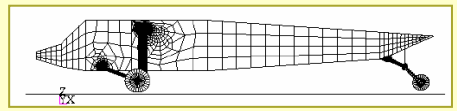
Rotorcraft

Reduced Operations and Support Costs

Propulsion and Drive Trains

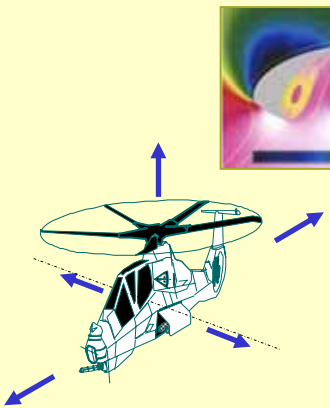
- Increased Fuel Efficiency
- Lighter Weight Components
- Small Heavy Fuel Engine

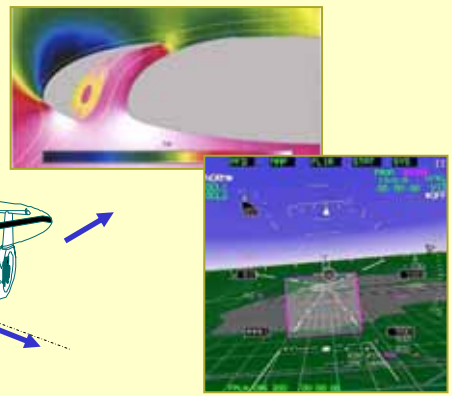
- Reduced Weight/Vibration
- Improved Reliability and Durability



Rotors and Flight Controls

- Intelligent & Active Rotors and Controls
- Embedded Actuators





Platform Technology

- Advanced Rotary Wing Concept Designs
- Aviation Weapons Integration
- Directed Energy/ Non-lethal Weapons Integration

Current Force—Advanced Simulation

Advanced Simulation

Cultural Awareness Simulation

Psychological Evaluation and Treatment

Adaptive Learning Environment

Joint Fires and Effects Trainer System

Urban Terrain
- Application of indirect effects in urban battlespace
- Cognitive proficiency for better decision-making

Fires & Effects Command (FEC)
- Testbed for system and human/machine interface requirements for Networked Fires Command node

Open Terrain
- Skill and cognitive trainer
- Mounted and dismounted
- Range of “individual” to “collective” tasks

Close Air Support (CAS)
- Movable flats for mixed reality environments
- 300-degree perimeter field-of-view
- 360-degree overhead field-of-view
- All rear projection

Future Force—Training Simulation

Adv Simulation

Training Strategies & Simulation

Next Generation Training Systems

Army Excellence in Leadership

Learning with Adaptive Simulation & Training

Progress in Autonomy & Cognition for Operational Capability

Million Instructions/ second

1B

10M

100K

1K

Key Challenges

- High speed mobility
  - Improved perception
  - Reliable data fusion
- Safe operations
  - Detect & classify stationary people & objects
  - Collision avoidance
- Design for tactical behavior flexibility
  - Understand environments
  - Decision processing
  - React appropriately to contact
- Collaboration
  - Conduct collaborative missions with mixed manned/unmanned force
  - Collaborative air-ground operations

Demo IIIa

True follower—follows in tracks of manned leader

On-road convoy operations

Armed Reconnaissance Vehicle—RSTA

Near autonomous team members

2000

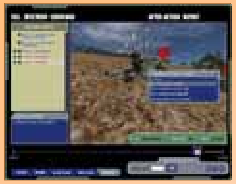
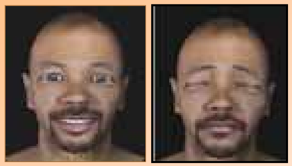
2005

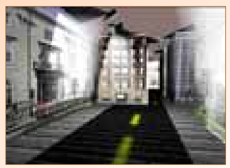
2008

2011

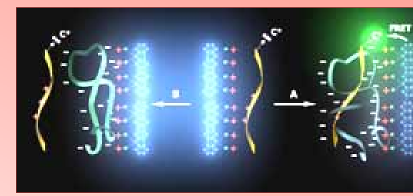
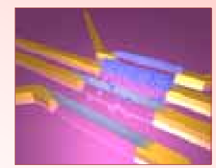
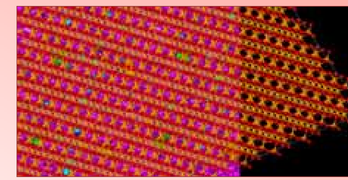
2015…

Shortening Cycle Time—Research to Products

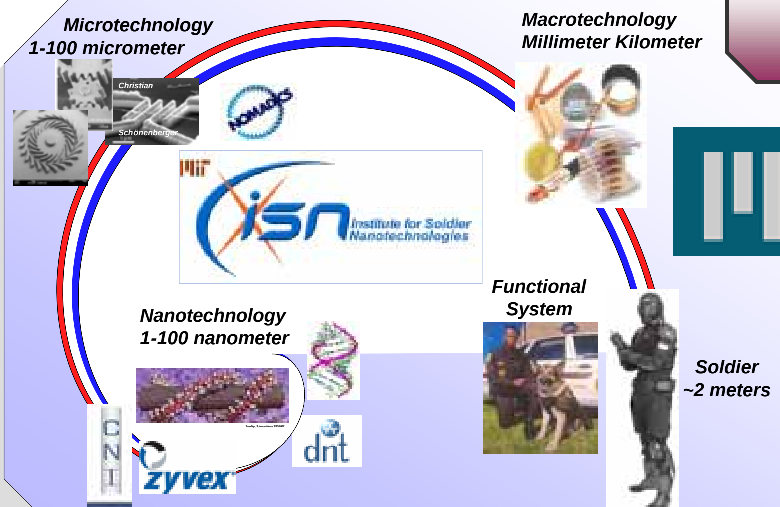


Immersive simulation for training, cultural awareness and mission rehearsal

Bio-inspired materials designs for energy, sensors, and networks

Transforming knowledge into Technology



Nanotechnologies for Soldier survivability


Develop high performance, commercially-viable, conformal and flexible displays

Army S&T…

Engine of Transformation