Army Science & Technology Overview

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Dr. Thomas H. Killion
Deputy Assistant Secretary for Research and Technology/Chief Scientist
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**

Future Force

- **< 40 lb. load**
- **Fully networked**
- **< 30 tons**
- **> 40 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**
## 6.1: Basic Research
18% of S&T

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

## 6.2: Applied Research
40% of S&T

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

## 6.3: Advanced Technology Development
42% of S&T

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

### Far Term
- Nanoscience
  - Atomic Structures—Integrated Circuit

### Mid Term
- Integrated Textile Conductors
  - Embedded Input Device
  - Power Transmitting Textiles
  - Embedded Circuits

### Near Term
- Precision Air Drop—50 meters

OSD Planning Framework

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

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.”

“...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 Environment
- Logistics and Medical in Counterinsurgency Operations and non contiguous battlespace
- Train the Force How and As it Fights
- Tactical Communications
- Ability to Conduct Joint Urban Operations
- Joint Interoperability, Coalition and Interagency Operations
- Enhanced ISR Capabilities
- Timeliness of Analysis, and Information Dissemination

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

FY08 $1.7B

- Force Protection $331M
- ISR $164M
- C4 $138M
- Lethality $168M
- Medical $136M
- Soldier $119M
- Logistics $90M
- Rotorcraft $70M
- Unmanned Vehicle $69M
- Classified $51M
- Mil Eng & Environment $44M
- Advanced Simulation $42M
- Basic Research $306M

Enabling the Future Force
Enhancing the Current Force
FCS Brigade Combat Team

Manned Ground Vehicles (MGV)
- Infantry Combat Vehicle (ICV)
- Command and Control Vehicle (C2V)
- Medical Vehicle Treatment (MV-T)
- FCS Recovery and Maintenance Vehicle (FRMV)

Unmanned Aerial Systems (UAS)
- Class I UAV
- Class IV UAV

Unattended Ground Systems (UGS)
- T-UGS
- U-UGS
- Non-Line of Sight Launch System (NLOS-LS)
- Tactical and Urban Unattended Ground Sensors

Unmanned Ground Vehicles (UGV)
- MULE-C
- MULE-T
- Mounted Combat
- Advanced Lightweight Armor
- Engine
- Medical Vehicle Evacuation (MV-E)
- Non-Line of Sight Mortar (NLOS-M)
- Non-Line of Sight Cannon (NLOS-C)
- Non-Line of Sight Launch System (NLOS-LS)
- Multifunction Utility/Logistics and Equipment Countermine and Transport
- Armed Robotic Vehicle – Assault (Light) (ARV-A-L)
- Small UGV (SUGV)

Common Chassis
Support to Current Operations
Demonstrations, Prototypes, or Limited Fieldings

<table>
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<tr>
<th>Category</th>
<th>Example</th>
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<tr>
<td><strong>Countermine/Counter Boobytrap</strong></td>
<td>WARLOCK Jammers</td>
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<td><strong>Enhanced Lethality</strong></td>
<td>Acoustic Gunfire Detection System SWORDS Special Purpose Munitions</td>
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<td><strong>Network</strong></td>
<td>Well Camera Secure Wireless Relays Satellite Nodes</td>
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<td><strong>Power &amp; Energy</strong></td>
<td>Zinc-Air Battery Family “AA” Battery Solar Charger SATCOM &amp; Javelin Hybrid Power Sources</td>
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<td><strong>Survivability</strong></td>
<td>Integrated Rocket, Artillery, Mortar (RAM) Detection Backstop</td>
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Current Force—Force Protection

Platform Protection
- Stryker w/Bar Armor
- Tactical Vehicle Add-on Armor
- Tear-off Windshields
- SAPI Plates
- Interceptor Body Armor
- Vehicle Class Body Armor Support System

Counter Rocket Artillery Mortar
- Backstop
- Lightweight Counter Mortar Radar
- Unattended Transient Acoustic MASINT System (UTAMS)

Countermine/Counter Boobytrap
- Detection, Surveillance, Neutralization and Defeat
- Airborne Detection
- Neutralization
- Robotic Detection/Neutralization
Future Force—Force Protection

**Platform Protection**
- Structural Armor
- Active Protection
- Laser Vision Protection
- Combat ID
- Integrated Rotorcraft Protection

**Counter Rocket Artillery Mortar**
- Modular Protective Systems for structures
- Extended Area Protection
- Solid State Laser (SSL) Weapon System Concept

**Countermine/Counter Boobytrap**
- Networked Electronic Warfare
- Concealed Explosives Detection
- Detection, Surveillance, Neutralization, and Defeat
- Packbot w/ sensor
Current Force—ISR and C4

Command & Control
- Urban Tactical Planner (UTP)
- Agile Commander

Networked Comms
- Airborne Network Extension
- Tele-engineering
- Extended Range Communications (Breadcrumb)
- Integrated Meteorological System

Surveillance & Sensors
- Well Camera & Remote Robotic Vehicle
- IR Sensors for Small Raven & Pointer
- Wide Field of View Night Vision Goggle
- Mobile Stabilized Panoramic Sight
- Pilar Gunfire Detection System

Overwatch—Detection & Classification of Hostile Fire

Agile Commander
Future Force—ISR and C4

Persistent Sensor Coverage
- 3rd Gen Infrared Sensors
- Layered Networked Sensors

Command & Control
- Knowledge Fusion

Tactical Mobile Networks
- Find the Enemy
- Assured Comms
- Battle Command

MOUT/Situational Awareness
- Through Wall Sensing
- Pos/Nav Network Assisted and Improved MEMS IMUs

Advanced Antennas
- Tactical Network & Communications Antennas
- Directional Antennas
Future Force—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 Prevention Vaccines
- Malaria Rapid Diagnostic Device
- Malaria Treatment Drugs
- Dengue Prevention Vaccines

**Operational Medicine**
- Remote Monitoring of Warfighter Health and Performance
- Performance Test for Future Lightweight Body Armor Systems
Future Force—Soldier Systems

Survivability
- Nanomaterials for Ballistic, Laser, Environmental Protection
- Modeling & Simulation
- Novel Fibers for Ballistic Protection

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
- Uncooled IR Sensors for UAVs
- Physiological Status Monitoring
- Electro-textiles

Sensors
- Realistic, Effective Training
- Uncooled IR Sensors for UAVs
- Pointer

Future Force Warrior
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

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

Power & Energy
- Heavy Fuel Engine
- Fuel Cell Development
- Hybrid Electric Drive
- Fuel Reformation

Deployability
- Lightweight Band Track
- Precision Air Drop 30k lbs

Sustainment
- Water Generation & Recovery
- EM Gun Munitions
- Prognostics/ Diagnostics

Future Tactical Truck System Concepts
- Utility Variant
- Sustainment Variant
Future Force—Lethality

Guns and Munitions
Electromagnetic Gun... paradigm shift in propulsion

Missiles
Future Missile Technology

Non-lethal
Multi-Mission High Power Microwave

Joint Small Arms
Lightweight Caseless Ammo

- Electronically Controlled Variable Effects Warheads
- Wall Breaching Munitions
- Small Arms Deployable Sensor Network
- Urban Assault Munitions

- Control Actuators
- IMU Guidance & Control
- GPS Receiver
- Non-Line of Sight Launch System (NLOS-LS)
- Precision Attack Missile (>40km)

- Ultra-short Pulsed Lasers
- Multi-Mission High Power Microwave

- Lightweight Weapon Component Technologies
- Target Acquisition Fire Control Sub-system

- Light Non-lethal Urban Assault Munitions
Future Force—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

Psychological Evaluation and Treatment

Cultural Awareness Simulation

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

Training Strategies & Simulation

Next Generation Training Systems

Army Excellence in Leadership

Learning with Adaptive Simulation & Training
Progress in Autonomy & Cognition for Operational Capability

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

- True follower—follows in tracks of manned leader
- On-road convoy operations
- Armed Reconnaissance Vehicle—RSTA
- Near autonomous team members

- Million Instructions/second
  - 1B
  - 10M
  - 100K
  - 1K

Shortening Cycle Time—Research to Products

Transforming knowledge into Technology

Immersive simulation for training, cultural awareness and mission rehearsal

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

Microtechnology
1-100 micrometer

Macrotechnology
Millimeter Kilometer

Nanotechnology
1-100 nanometer

Functional System

Soldier
~2 meters

Nanotechnologies for Soldier survivability

Develop high performance, commercially-viable, conformal and flexible displays
Army S&T...

Engine of Transformation