

Army Science & Technology



Future Needs and Capabilities

Brief to the Military Medicine Partnership Days



Kristopher Gardner
Acting Director for Research & Technology
Office of the Deputy Assistant Secretary of the Army
(Research and Technology)

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



Chief of Staff of the Army – Future Army Priority

“We will do what it takes to build an agile, adaptive Army of the future. We need to listen and learn - first from the Army itself, from other Services, from our interagency partners, but also from the private sector, and even from our critics. Developing a lethal, professional and technically competent force requires an openness to new ideas and new ways of doing things in an increasingly complex world. We will change and adapt.”



MARK A. MILLEY
General, United States Army
39th Chief of Staff of the Army



Army S&T Principles

MISSION: Identify, develop and demonstrate technology options that inform and enable effective and affordable capabilities for the Soldier

VISION: Providing Soldiers with the Technology to Win

Current Force



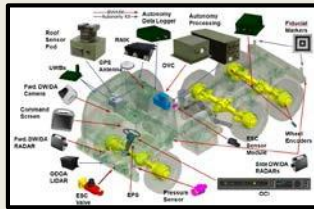
Deployable Force Protection Adaptive Red Team



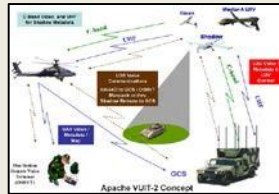
Advanced Rotary Wing Aerial Delivery Sling Load Net



High Speed Container Delivery System



Autonomous Mobility Appliqué System



Video from Unmanned Aerial Systems



Enabling the Future Force

Enhancing the Current Force

Future Force



Cyber tools

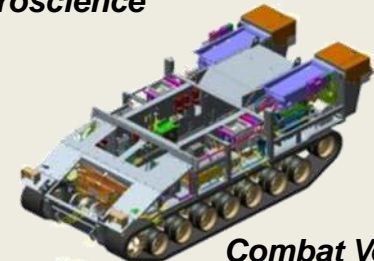
Next Generation Rotorcraft



Neuroscience



High Energy Lasers



Combat Vehicle Prototyping



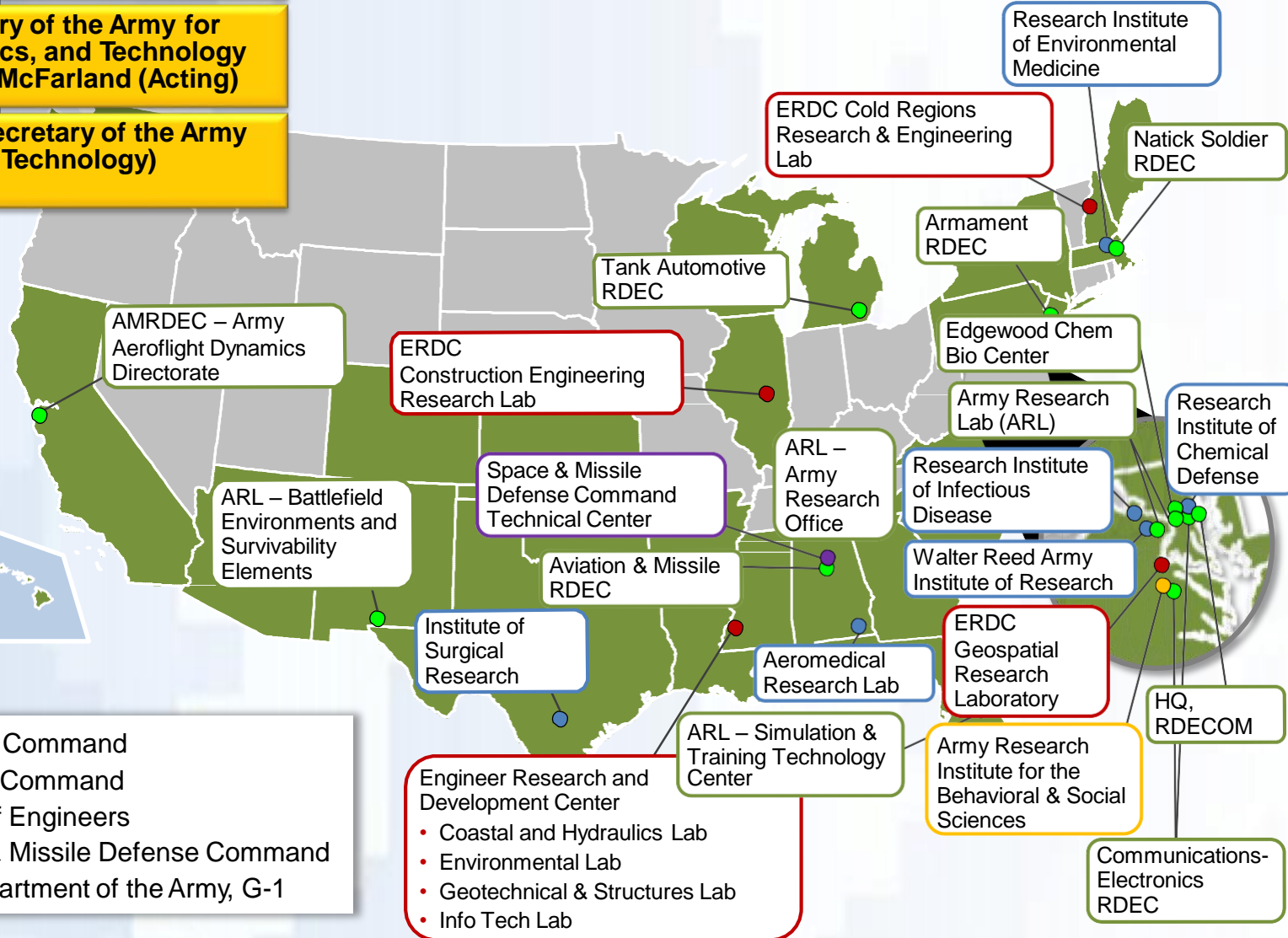
Army S&T Enterprise

Secretary of the Army
Honorable Patrick J. Murphy (Acting)

Under Secretary of the Army
Honorable Patrick J. Murphy

Assistant Secretary of the Army for Acquisition, Logistics, and Technology
Honorable Katrina McFarland (Acting)

Deputy Assistant Secretary of the Army (Research & Technology)



- U.S. Army Materiel Command
- U.S. Army Medical Command
- U.S. Army Corps of Engineers
- U.S. Army Space & Missile Defense Command
- Headquarters, Department of the Army, G-1



Army Enduring Challenges

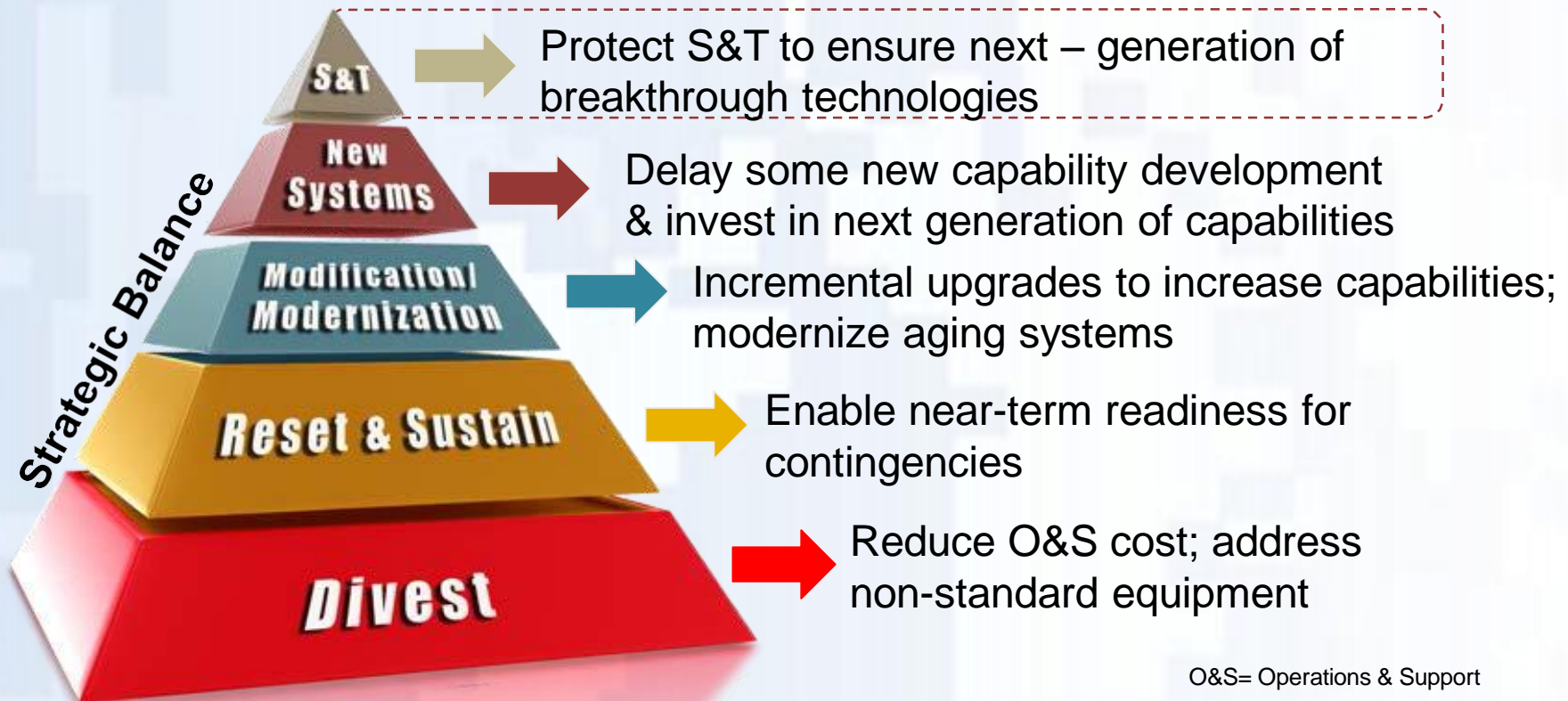
- Greater **force protection (Soldier, vehicle, base)** to ensure survivability across all operations
- Ease **overburdened** Soldiers in Small Units
- Timely **mission command & tactical intelligence** to provide situation awareness and communications in all environments
- Reduce logistic burden of **storing, transporting, distributing** and **retrograde** of materials
- Create **operational overmatch** (enhanced lethality and accuracy)
- Achieve operational **maneuverability** in all environments and at **high operational tempo**
- Enable **early detection and improved outcomes for Traumatic Brain Injury (TBI) and Post Traumatic Stress Disorder (PTSD)**
- Improve **operational energy**
- Improve **individual & team training**
- **Reduce lifecycle cost** of future Army capabilities



Modernization Strategy in a Fiscally Challenged Environment



- Reduce procurement quantities to match force structure reductions
- Gained efficiencies
 - Leveraging multi-year procurement (Black Hawk, Chinook)
 - Incorporate Better Buying Power initiatives (contracting, should-cost, competition)





Emerging Areas of Interest

- **Third Offset**
- **Technology Wargaming**
- **Army S&T Red Teaming**





Third Offset Concept Areas

- **Long-Range Weapons** -- Weapons and concepts for Surface-Strike and Air-to-Air Combat
- **Low-Cost Defense** -- Ability to defend key capabilities or locations (Maneuver Forces and Operating Bases)
- **Autonomy and Artificial Intelligence**
 - Autonomous "deep learning" machines and systems to improve early warning
 - **Human-machine collaboration, specifically in assisted decision-making**
 - Assisted-human operations, or ways that machines can make the human operate more effectively
 - Advanced human-machine teaming
 - Semi-autonomous weapons that are hardened to operate in an electronic warfare environment
- **Cyber and EW Capabilities** including **Advances in Cognitive Systems that can Sense, Learn, and React Automatically**
- Expand **Wargaming**, Conduct **Prototyping**, Test New Operational Concepts, Tactics, Techniques and Procedures



Technology Wargaming Overview

“...The elite amateurs were on average about 30% more accurate than the experts with access to classified information...the full pool of amateurs also outperformed the experts. The most careful, curious, open-minded, persistent and self-critical...did the best.”¹

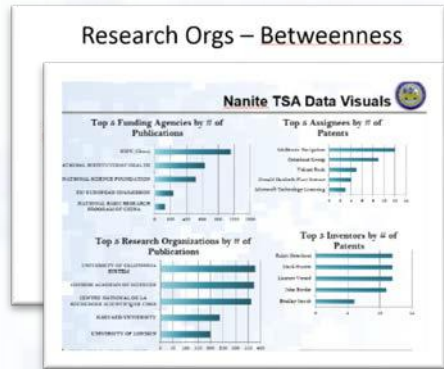
- Crowdsource future capabilities from the Army S&T enterprise, academia, and non-traditional DoD thinkers
 - Mitigates risk of cognitive bias’s within the Department of the Army by leveraging the creativity and insight of non-traditional DoD individuals and organizations
 - Executed through in-person and online ideation exercises
- Analyze potential technologies using bibliographic-based data analytics (universities, personnel, countries performing the research)
- Create a functional decomposition of a potential capability through SME review
- Assign probabilities and perform Monte Carlo Simulation to create a here-to-there narrative for how basic science advances will produce an Army capability through a Technology Sequence Analysis (TSA)
- Provide broad future S&T context in Annual Trends Report

<http://futures.armyscitech.com>

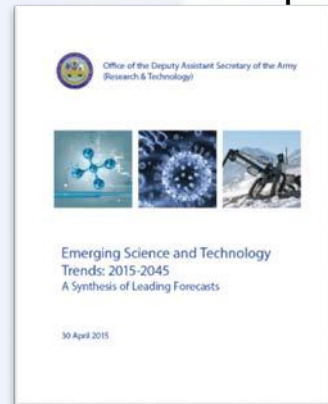
Crowdsourcing



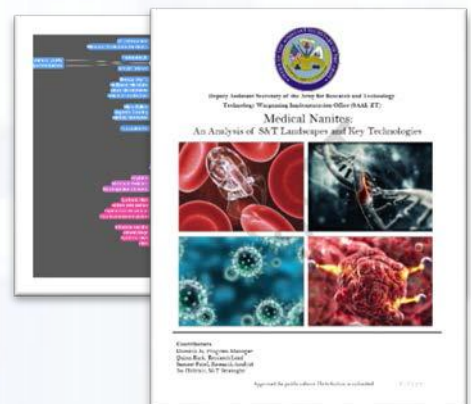
SME-Informed Bibliometric Search



S&T Trends Report



Deep Dive Analysis



¹ Zweig, J. (2015, September 25). The Trick to Making Better Forecasts. Retrieved November 20, 2015, from <http://www.wsj.com/articles/the-trick-to-making-better-forecasts-1443235983>

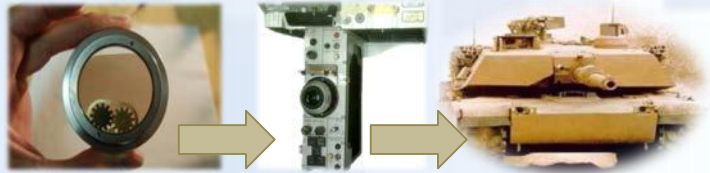
Army S&T Red Teaming

New theaters present new challenges – future operations with technically savvy opponents require “red teaming” of technologies and systems to maintain military superiority

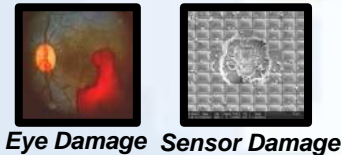
Identify and understand potential vulnerabilities early in the materiel development lifecycle

Independent Assessment of:

- Integrated Sub-Systems/Systems
- Emerging Technology Components



Sensor Protection against Future Threats



Red Team with adversary tools and methods



- Conduct lab, virtual, and live field red teaming to stress and assess technology components and integrated systems
- Use state-of-the-art tools and methodologies to identify potential vulnerabilities across a spectrum of threats and environments
- Provide opportunities for design and/or employment improvements to benefit the Warfighter
- Challenge conventional approaches to insertion – identify risks, reduce vulnerabilities and optimize performance in operations

What the Army Needs

- **Alternate/Redundant (and Affordable) Capabilities**
- **Open Systems Architectures that lead to Ease of Upgrades**
- **Understanding of the Vulnerabilities in both Technology and Systems (and Mitigation Strategies)**
- **Lower Cost, Capable Systems**
- **Simplicity vs. Complexity**



***We must leverage Industry R&D efforts to provide
the best technology to our Soldiers***

Specific Examples...

• Ground Maneuver

- Holistic/synergistic protection, adaptive armor, and Upgradable Active Protection Systems (APS)
 - Low-cost sensors/algorithms for tracking and cueing targets in cluttered environments
 - Counter-munition capability to defeat RPGs/ ATGMs with expandable capabilities
- Energy dense engines for improved mobility and fuel efficiency
- Open and Common power and digital data management and distribution

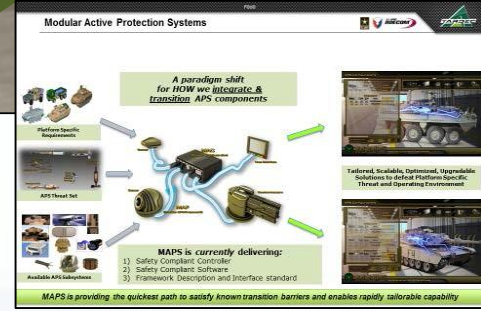
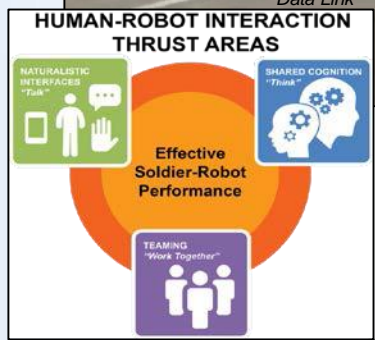
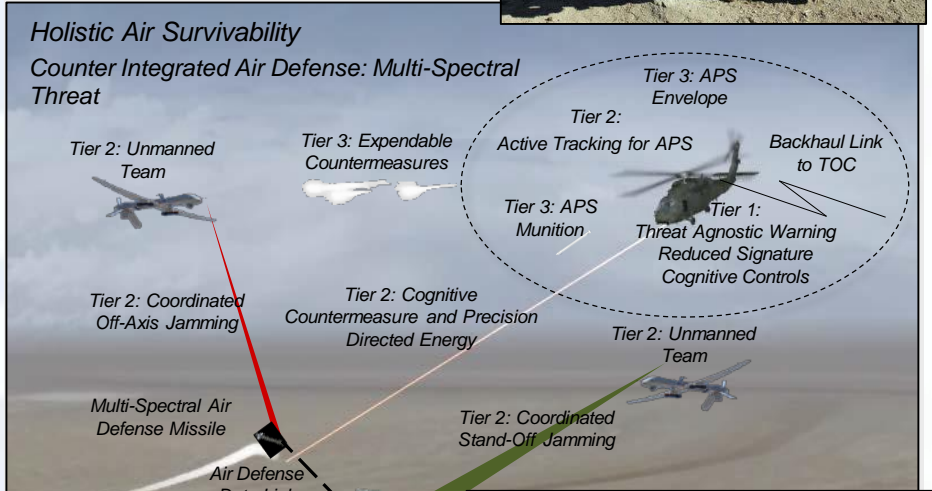


• Soldier/Squad

- Material and textiles for individual protection
- Lightweight, low-cost Situational Awareness techs
- Human Performance
 - Human Performance Monitoring and Augmentation (exoskeleton, vision and hearing aides, etc)
 - Interactive Synthetic Training Environments
 - Artificial Intelligence, Autonomous Learning Systems

• Air

- Advanced Aircraft Survivability
 - Affordable multi-spectral sensors
 - Threat-agnostic detection/warning systems
 - Integrated Electronic Counter-Measures (ECM)
- Advanced Aircraft Design and Power Systems
- High Performance Rotors
- Effective diagnostics/prognostics



Specific Examples...

• Command Control Communications & Intelligence

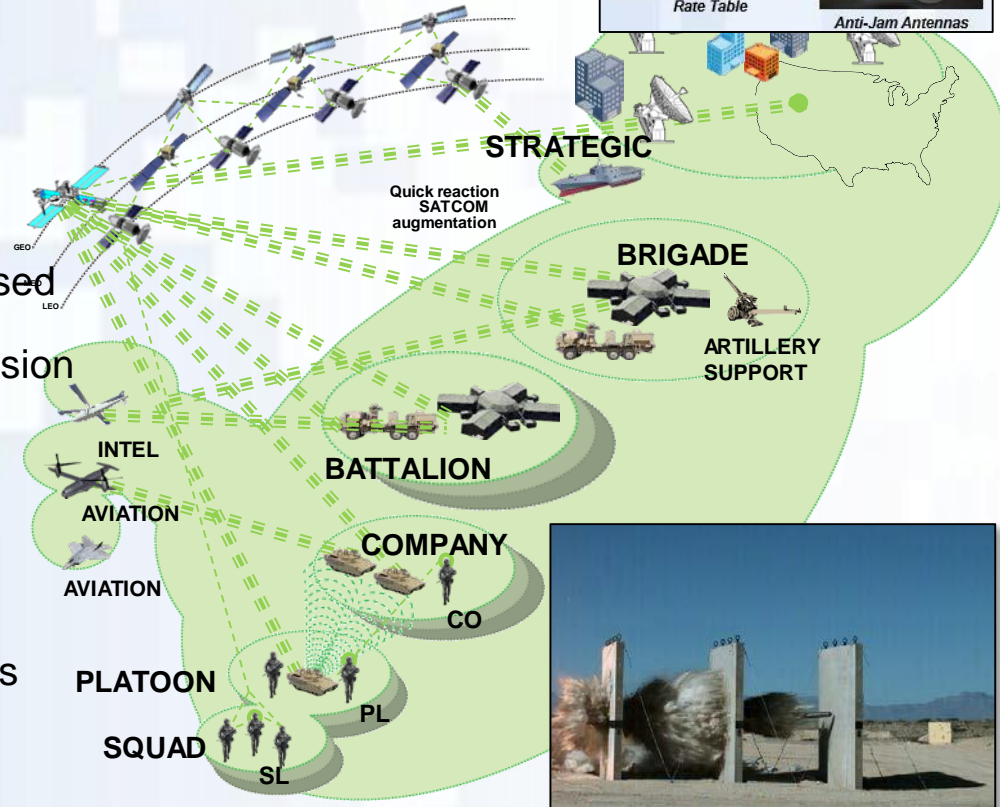
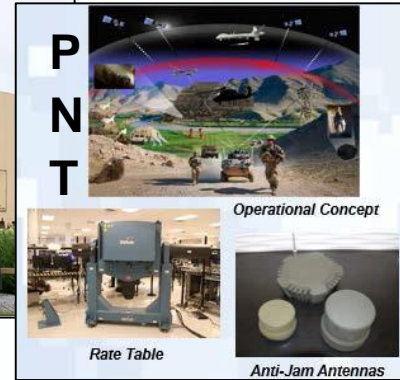
- Radio Frequency Spectrum Agility
 - Assured Communications, Undetectable Comms
 - Position, Navigation & Timing (PNT) Alternatives (that maintain accuracy up to 72hrs in denied environments)
 - Cyber/EW Convergence
- Common Integrated Architectures
- 3D Digital Read Out Integrated Circuits for Focal Plane Arrays
- Energy efficient electronic components

• Lethality

- Directed Energy
 - Low-cost, lightweight agile beam-control system
 - On-the-Move target/track capability
- Energetics, Propulsion and Warheads for increased range and effects
- Guidance for improved and/or GPS-denied precision
- Seeker technologies to defeat moving targets and air defense threats

• Innovation Enablers / Basic Research

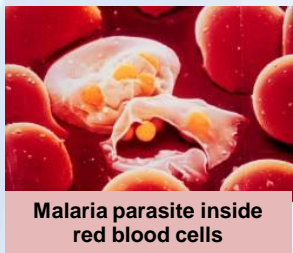
- Affordable net-zero technologies to achieve sustainable installations and bases
- Hi-fidelity, physics-based models of platform performance in realistic operational environments
- Autonomous systems with a focus on enhanced intelligence, biomimetic functionality, and robust mobility that enables teaming with Soldiers



Medical S&T Initiatives

Infectious Disease
 Driver: Counter infectious diseases & persistent environmental health hazards

Goal: Develop methods to prevent, treat, and / or diagnose naturally occurring viral, parasitic and bacterial diseases and infections that can impact military mobilization, deployment, or force effectiveness.



Malaria parasite inside red blood cells



Drug development with commercial partner



The final product

Prophylactic Drugs to Prevent Drug Resistant Malaria

Combat Casualty Care
 Driver: Counter effects of conventional and emerging threats

Goal: Develop capabilities to support first responders, increasing survival rate of preventable combat deaths and improve recovery.



Refrigerated platelet storage technology



Fracture Putty



Non-Invasive Neuro-Diagnostic (NINAD) for TBI

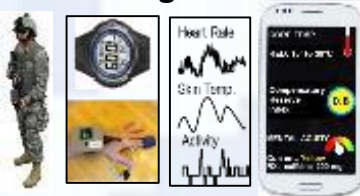
Military Operational Medicine
 Driver: Enable Warfighter performance in austere environments / extended operations

Goal: Establish and maintain optimal mental and physical health and fitness through development of health and performance metrics and strategies allowing longitudinal assessment, monitoring & intervention.



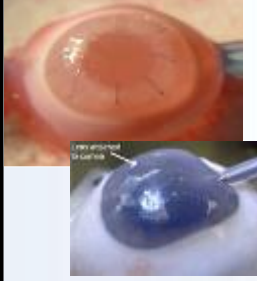
Biomarker for detection of Multiple Organ injury

Tailored, Individualized Health and Performance Monitoring



Clinical and Rehabilitative Medicine
 Driver: Preserve combat power

Goal: Identify drugs, biologics, medical devices / procedures to minimize long-term effects of battlefield injury, enhance recovery, enable efficient Return to Duty and overall improved quality of life.



Temporary Corneal Repair



Stratagraft (left) vs. Autograft Repair (right)

Synthetic skin



Opportunities for Engaging the Army

DEFENSE INNOVATION MARKETPLACE

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WHAT'S NEW

Solicitations

- Army Biological Services (Closes 1/25/2016)
- Air Force Distributed Operations (Closes 9/30/2015)
- Navy Capabilities Demonstration CDR (Closes 1/6/2016)
- NASA Scientific Analysis Software (Closes 1/12/2016)
- DARPA Strategic Technologies (Closes 12/21/2016)

>> View More

Air Force Cyberspace TIM coming soon, 2-5 Feb. 2016

CONNECTING INDUSTRY AND DoD

The Defense Innovation Marketplace is a communications resource to provide industry with improved insight into the Research and

www.DefenseInnovationMarketplace.mil

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- ✓ Materials Research
- ✓ Assessment and Analysis



Army Science & Technology



Providing Soldiers with the Technology to Win

