

Conceptualizing 2040 & Beyond

Innovation that Provides the Army Required Capabilities

MG John Wharton
Commanding General
U.S. Army Research, Development and Engineering Command



What I Want to Leave You With

- Thank you for what you do in support of our Army and Nation!
- RDECOM is Technology Driven - Warfighter Focused
- The Army Operating Concept is our foundation and will drive our S&T strategy
- The Army does not buy “things” to fight . . . we build “capabilities” to win for our Nation
- We have aligned our programs to requirements ... we must operationalize what we do
- Partnerships with industry, academia, DoD labs, and our Allies are essential

Innovation is key to our success!



RDECOM will ensure decisive overmatch for Force 2040B

What Our Army's Leaders are Saying



Mr. John McHugh, Secretary of Army

“We want to ensure that we invest in innovations that continue to give us the technological edge that our forces need to take on whatever tomorrow's mission might be.”



General Raymond T. Odierno, Chief of Staff of the Army

“We must maximize Army capabilities, align Army goals and objectives for R&D and S&T and link them to Army 2025 and beyond.”



Ms. Heidi Shyu, Assistant Secretary of the Army for Acquisition, Logistics and Technology

“The Army has by and large protected its S&T budget. The American Soldier is the best equipped in the world – thanks to our materiel enterprise. We must continue to invest in S&T in order to equip our Soldier of the future.”

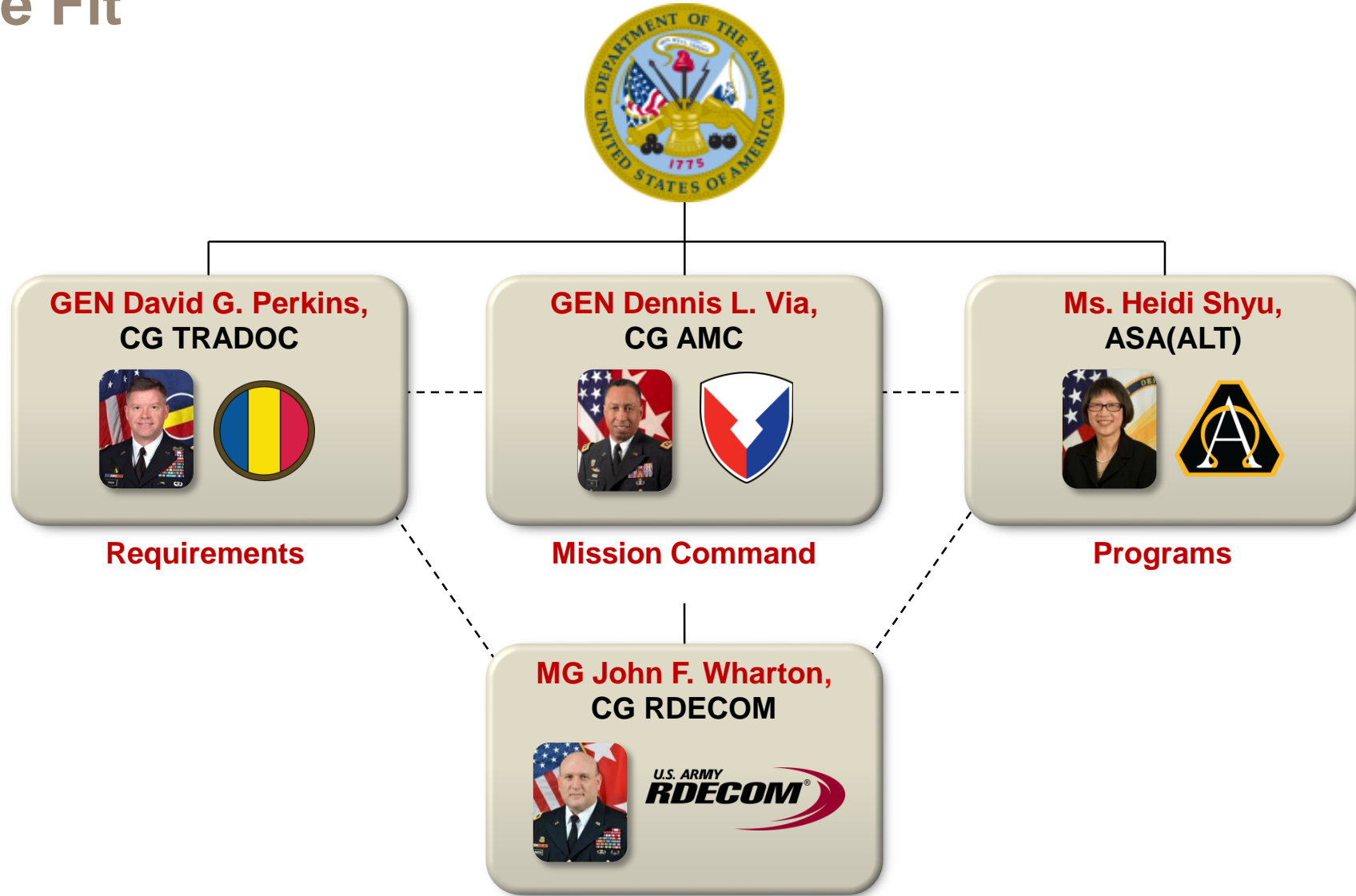


General Dennis L. Via, Commanding General, Army Materiel Command

“If the US armed forces don't continue to invest in science and technology research in order to push capabilities forward, the ability of US forces to overwhelm competitors will dissipate.”

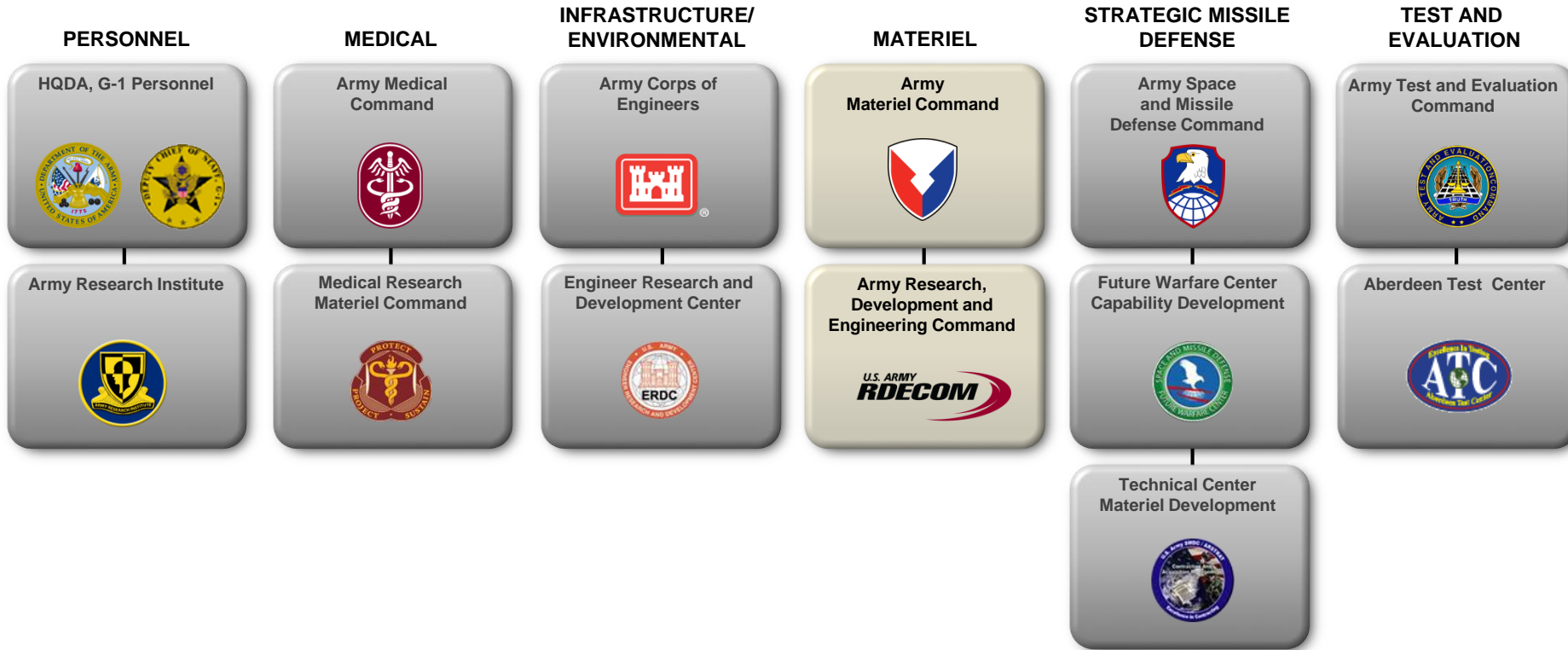
Continued investment in S&T enables our decisive overmatch

How We Fit



Synchronizing programs with requirements

Army S&T Performing Organizations



RDECOM is a critical component of the Army S&T enterprise

Our Organization



Mission

To ensure decisive capabilities for unified land operations to empower the Army, the joint warfighter, and our Nation.

Vision

The preeminent world leader in research, development, and engineering.



Integrating leading-edge research, development and engineering

Our Organization



Mission

To ensure decisive capabilities for unified land operations to empower the Army, the joint warfighter, and our Nation.

Vision

The preeminent world leader in research, development, and engineering.



Preeminent technical leadership in research development and engineering

What We Do

Armaments

Research, Development and Engineering Center (ARDEC)

- Munitions Systems & Technologies
- Integrated Weapon Systems
- Energetics & Warheads
- Guidance, Navigation & Control
- Fuzing System
- Remote Weapon Stations/Weapon Pods
- Fire Control Systems
- Grenades/Demolitions
- Non-Lethal Weapons & Target Effects
- Ammunition Logistics

Aviation and Missile

Research, Development and Engineering Center (AMRDEC)

- Airframe Structures
- Rotors & Rotor Systems
- Sensors and Seekers
- Guidance, Navigation, and Control
- Propulsion
- Warhead & Fuze Integration
- Fire Control

Tank Automotive

Research, Development and Engineering Center (TARDEC)

- Advanced ground system technologies.
- Survivability
- Autonomy
- Vehicle Electronic Architecture
- Power & Mobility
- Fuels & Lubricants
- Ground system technology integration.
- Virtual and physical ground system analysis

Army Research Laboratory (ARL)

- Extramural Basic Research
- Computational Sciences
- Materials Research
- Sciences-for-Maneuver
- Information Sciences
- Science-for-Lethality and Protection
- Human Sciences
- Assessment and Analysis

Communications-Electronics

Research, Development and Engineering Center (CERDEC)

- Night Vision Technology
- EO/IR & Multi /Hyperspectral Sensors
- Antennas Technologies
- C-IED & Counter Mine Technology
- Cyber Security
- Networks and Communications
- Electronic Warfare
- Mobile Power / Advanced Battery Tech.
- Surveillance Systems

Edgewood, Chemical Biological Center (ECBC)

- Chemistry and Biological Sciences
- CB Agent Handling and Surety
- CBRNE Materiel Acquisition
- CBRNE Analysis and Testing
- CBRNE Munitions and Field Operations
- Science and Technology for Emerging Threats

Natick Soldier

Research, Development and Engineering Center (NSRDEC)

- Textiles and Uniforms
- Shelters
- Joint Combat Feeding
- Cognition
- Soldier Performance/Assessment
- Body Armor



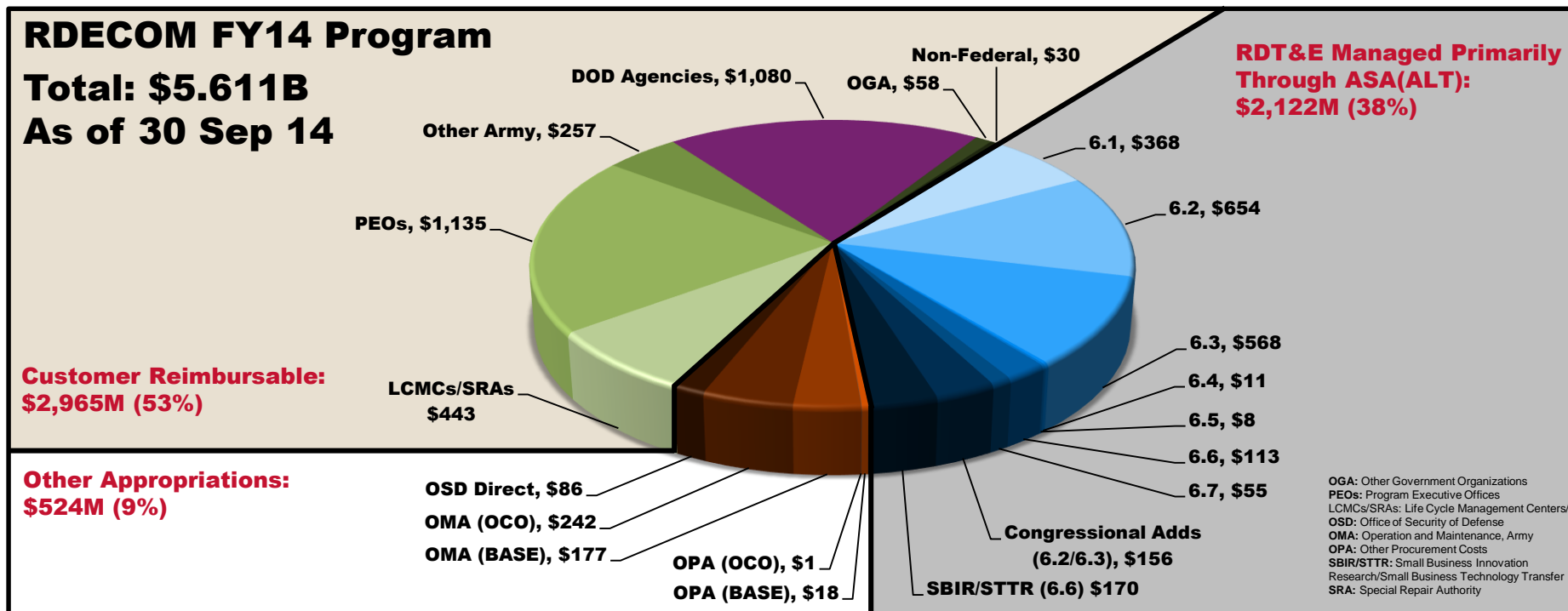
Delivering capabilities for the Army, joint warfighters, and our Nation

Support to The Nation and Allied Partners



Delivering capabilities to meet National and joint requirements

Today's Investments Enable Tomorrow's Capabilities



6.1	6.2	6.3	6.4	6.6	6.7
<p>Basic Research</p> <p>Investigation & analysis of basic law of nature, phenomenon to increase scientific knowledge</p> <p>64% Universities/ Industry 33% In-House 3% OGA, Other</p>	<p>Applied Research</p> <p>Application of knowledge to develop useful materials, devices and systems or methods</p> <p>33% Industry 53% In-House 14% OGA, Other</p>	<p>Advanced Technology Development</p> <p>Development of subsystems & components to integrate into system prototypes</p> <p>60% Industry 28% In-House 12% OGA, Other</p>	<p>Adv. Component Development and Prototypes</p> <p>Maturation of systems/sub-systems through competitive prototyping and experimentation</p> <p>90% Industry 10% In-House</p>	<p>RDTE Management Support</p> <p>RDT&E Management Support</p> <p>90% Industry 10% In-House</p>	<p>Operational System Development</p> <p>Manufacturing technologies and pre-planned product improvements</p> <p>84% Industry 16% In-House</p>

*Approx Figures

Why Innovate?

1970s – Today

...Fight Outnumbered and Win

- Focus on weapons systems
- Countered near-peer capability
- Unmatched advantage today

2025

...80–85% Built

- Known capability
- Mature technology
- Little science

F2040

...25% Built

- Unknown capability
- Immature technology
- Much science



M1



2040



UH-60



2040



PATRIOT



2040



AH-64



2040



M2



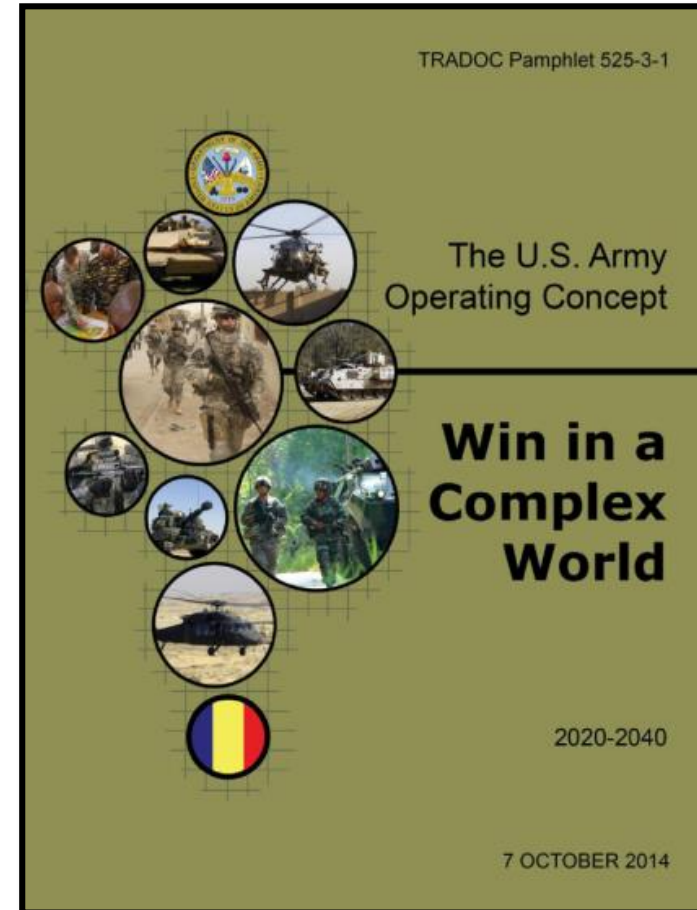
2040



Focus on modernization, innovation and developing new capabilities

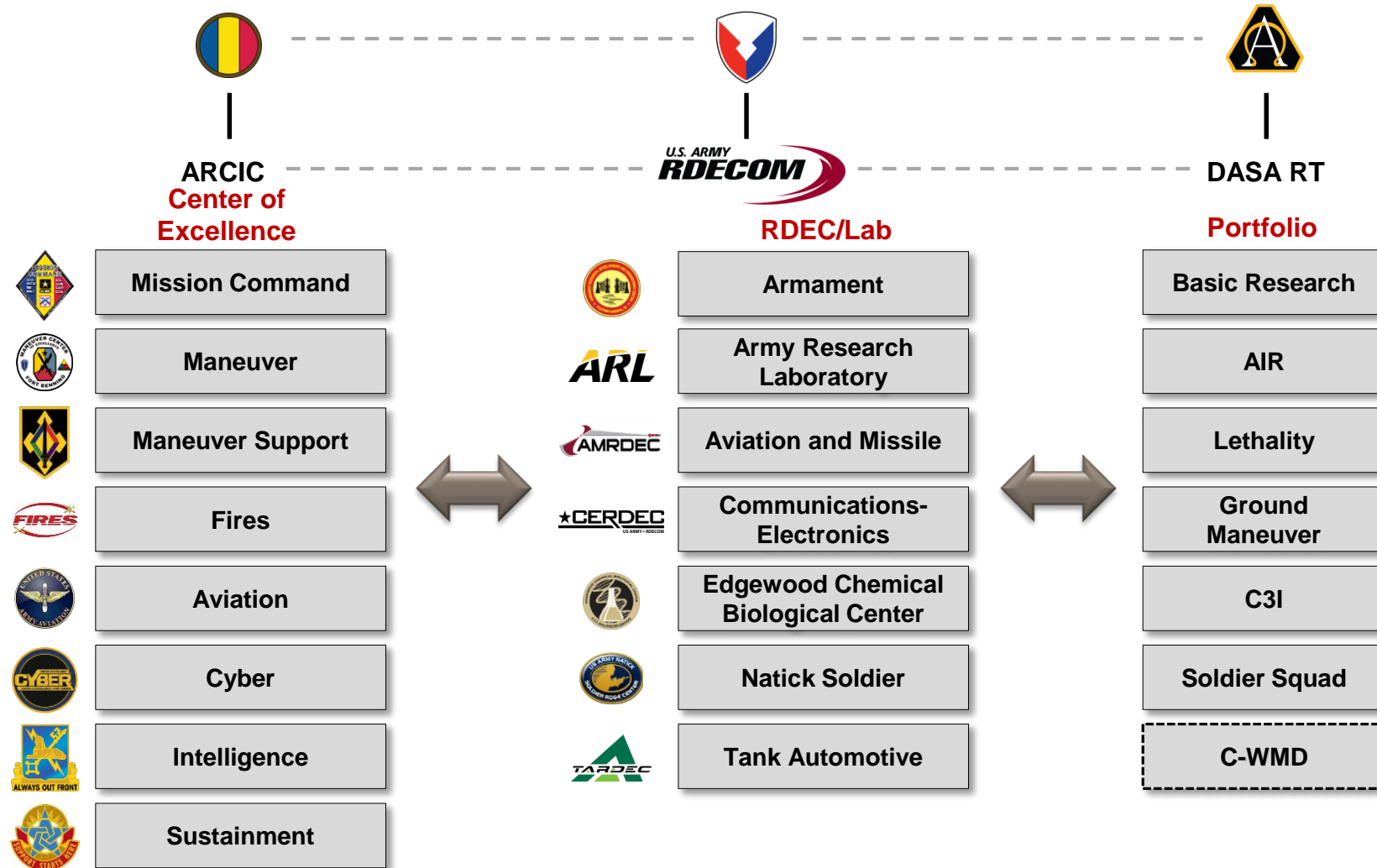
The Army's Operating Concept

- Describes how the Army of the **future** will fight
- Capabilities **overmatch**
- **Optimized** Soldier and team performance
- Joint / inter-organization / **interoperable**
- **Scalable** and **tailorable joint** combined arms forces
- **Adaptive** professionals and institutions to operate in complex environments
- Calls for the Army to **innovate!**



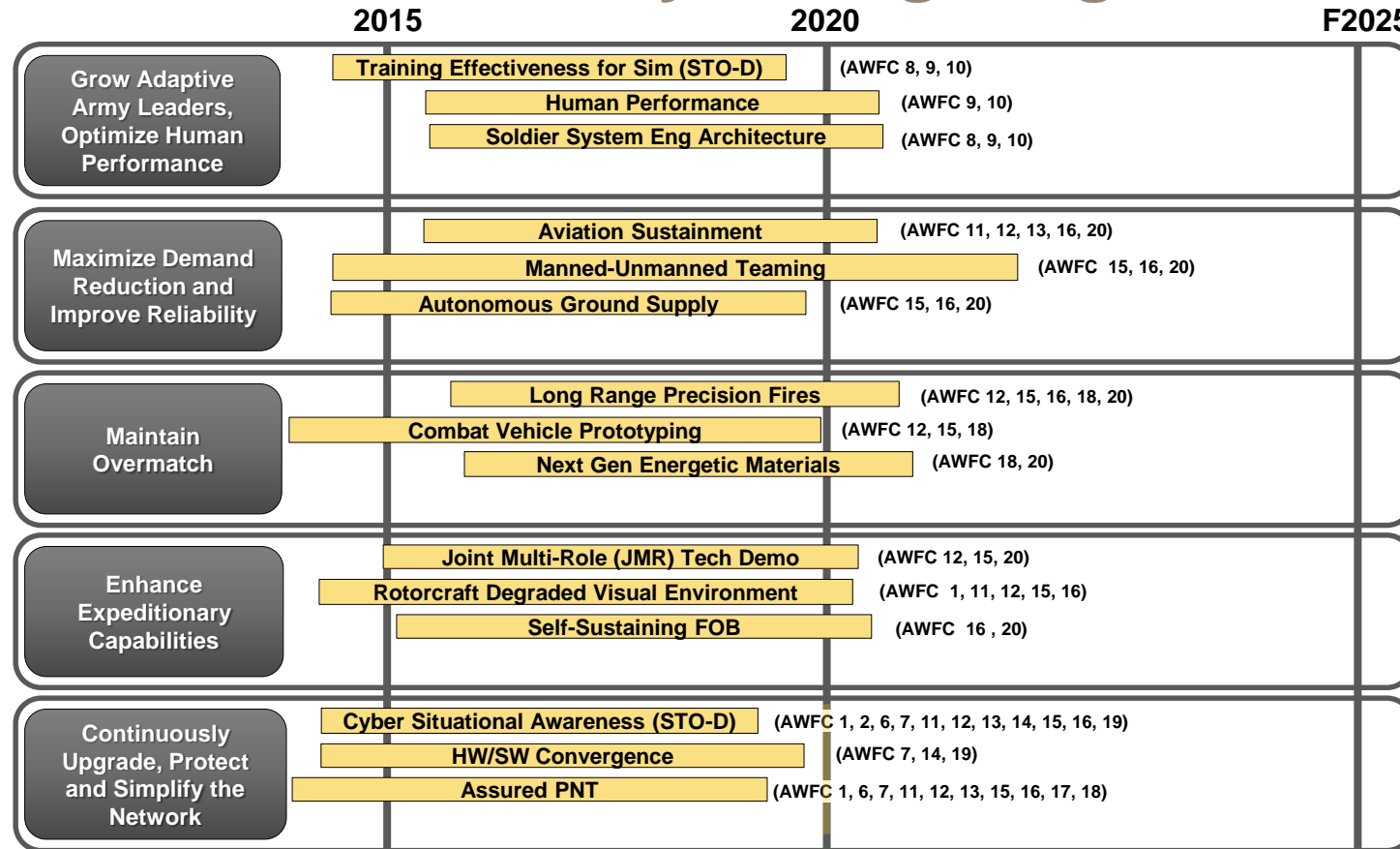
S&T priorities form RDECOM's intellectual underpinnings

Aligning Programs to Requirements



Synchronizing Army S&T priorities

Aligning S&T Priorities to Army Warfighting Challenges



Representative Sample of Technology Groups/Integrated Programs

- AWFCs
- 1 – Develop situational understanding
 - 2 – Shape the security environment
 - 3 – Provide security force assistance
 - 4 – Adapt the institutional Army
 - 5 – Counter WMD
 - 6 – Conduct Homeland Operations

- AWFCs
- 7 – Conduct Space and Cyber Electromagnetic Operations and Maintain Communications
 - 8 – Enhance Training
 - 9 – Improve Soldier, Leader, and Team Performance
 - 10 – Develop Agile and Adaptive Leaders
 - 11 – Conduct air-ground reconnaissance
 - 12 – Conduct entry operations
 - 13 – Conduct wide area security

- AWFCs
- 14 – Ensure interoperability and operate in a JIM environment
 - 15 – Conduct combined arms maneuver
 - 16 – Set the theater, sustain operations, and maintain freedom of movement
 - 17 – Integrate fires
 - 18 – Deliver fires
 - 19 – Exercise Mission Command
 - 20 – Develop capable formations



RDECOM aligned S&T investments to support TRADOC requirements



3D-LZ JCTD MUA FALCONS



14:37:43 398279
14:37:43:4
2014/09/11
EGI: Nov
LADAR VIEW

45
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T



LZ FALCONS
DIST 0.15 nm
HDG 350
TYPE Landing

LADAR
VIEW PT:
NOSE

32G

116

116

NOSE

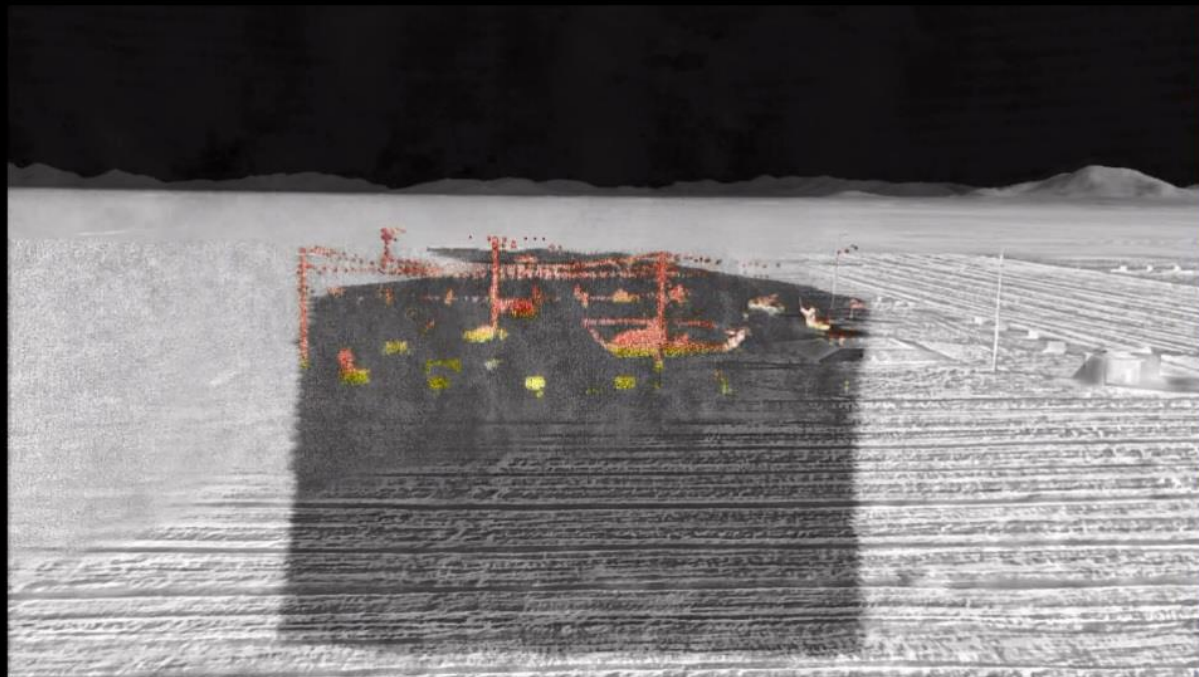


CHASE

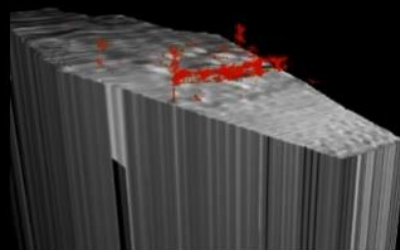
OVERHEAD



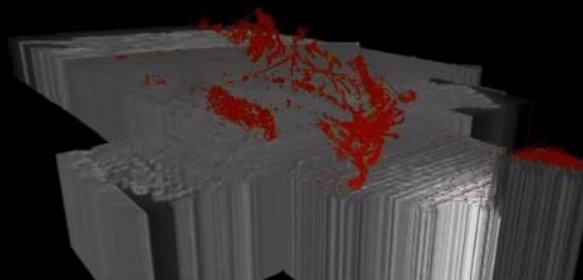
RDECOM DVE
Mitigation Ground
Test, YPG, FEB 2015.
Sensors collocated on
an 80' tower. Dust
generated by a UH-60.



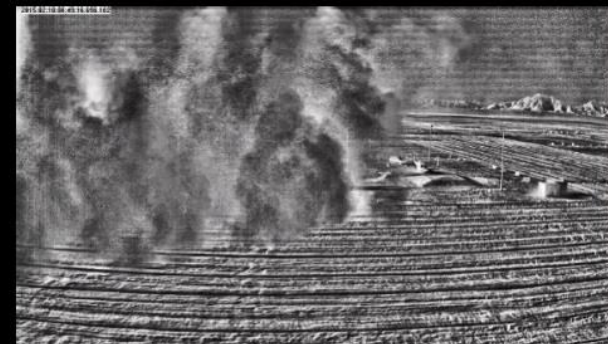
Fused Image



94GHz Radar



Scanning LADAR



Modified LWIR






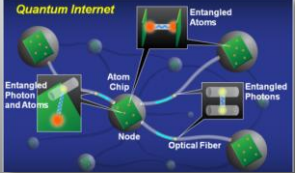
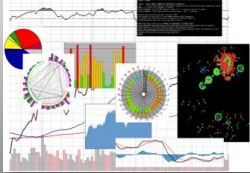

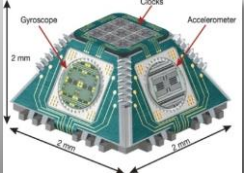

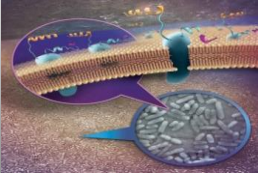



Ensuring the Decisive Edge – Mid Term and Deep Future

<p>Adaptive Army Leaders/Human Performance Optimization</p>  <p>Soldier Systems Engineering Architecture</p>  <p>Combat Feeding</p>  <p>Advanced Simulation Training</p>  <p>Human Performance</p>	<p>Maximize Demand Reduction and Improve Reliability</p>  <p>Alternate Sources of Water - WFAS</p>  <p>Autonomous Resupply</p>  <p>Manned-Unmanned Teaming</p>  <p>Aviation Sustainment</p>	<p>Maintain Overmatch</p>  <p>Prototyping</p>  <p>Long Range Precision Fires</p>   <p>Additive Manufacturing</p>  <p>Next Generation Energetics</p> 
<p>Continuously Upgrade, Protect, and Simplify the Network</p>  <p>Assured Position, Navigation, and Timing (PNT)</p>  <p>Quantum Science</p>  <p>Cyber SA</p>  <p>HW/SW Convergence</p>		<p>Enhanced Expeditionary Capabilities</p>  <p>Power Management</p>  <p>Self Sustaining FOB</p>  <p>Cargo Pocket ISR</p>  <p>Joint Multi-role</p> 

Capabilities aligned with TRADOC Key Technology Imperatives


















The Science Behind Ensuring Future Overmatch

<p>Disruptive Energetics</p> 	<p>Human Systems Integration–Cybernetics</p> 	<p>Quantum Sciences</p> 	<p>Intelligent Systems</p> 
<p>Enhancing Training and Simulation</p> 	<p>Exploitation of Quantum Effects</p> 	<p>Cyber Research</p> 	<p>Chemical and Biological Defense</p> 
<p>Position Navigation and Timing (PNT) Technologies in Anti-Access/Area Denial Environments</p> 	<p>Omnipresent and Multi-Aspect Soldier Assessment through Wearable Technologies</p> 	<p>Beyond Novel Materials</p> 	<p>Integrated Space and Cyber Electromagnetic Operations</p> 

Innovative discoveries pushing beyond requirements

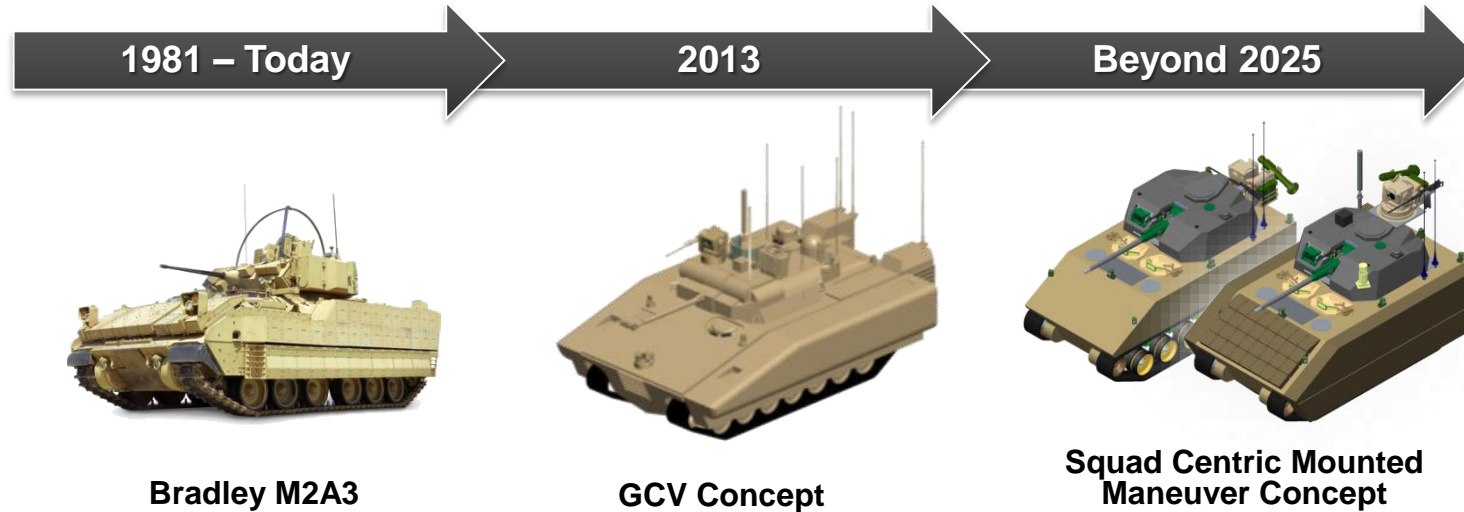
Future Soldier 2040 ... Some Thoughts



FOCUS AREA	RDECOM INTEGRATION						
<p>INTEGRATED HEADBORNE SYSTEM</p> <ul style="list-style-type: none"> • Weapon Signature Detection • Shock Resistance • Passive/Active Eyewear • Assisted Threat Recognition • Audio/Visual Stimulus Management 	ARL						
<p>WEAPONS SYSTEM</p> <ul style="list-style-type: none"> • Advanced Obscurants • Augmented Target Acquisition • Munitions Launched SA Tools • Squad Threat Prioritization and Delegation 	ARL						
<p>SOLDIER/SQUAD COMMUNICATION INTEGRATION</p> <ul style="list-style-type: none"> • Mission Planning • Augmented Reality • Soldier/Squad Communication Integration • On-demand resupply • Situational Awareness • Autonomous ISR 	ARL						
<p>COMBAT PROTECTIVE ENSEMBLE</p> <ul style="list-style-type: none"> • Regionally Adaptive Combat Ensemble • Personally Tailored Protective Gear • Personally Adapted Nutrition for Performance • Adaptive Signature Management • Stealthy Insertion and Extraction <p>ADVANCED BODY ARMOR</p> <ul style="list-style-type: none"> • Lightweight Armor Suite • Pro-active "Living" Armor • Direct Energy Protection • Automated First-Aid 	ARL						
<p>HUMAN AUGMENTATION & ENERGY HARVESTING</p> <ul style="list-style-type: none"> • Load Carriage Alternatives • Wearable Multi-Source Energy Harvesting • Photovoltaics • Strength Augmentation 	ARL						

Ensuring our Soldiers are the best equipped in the World

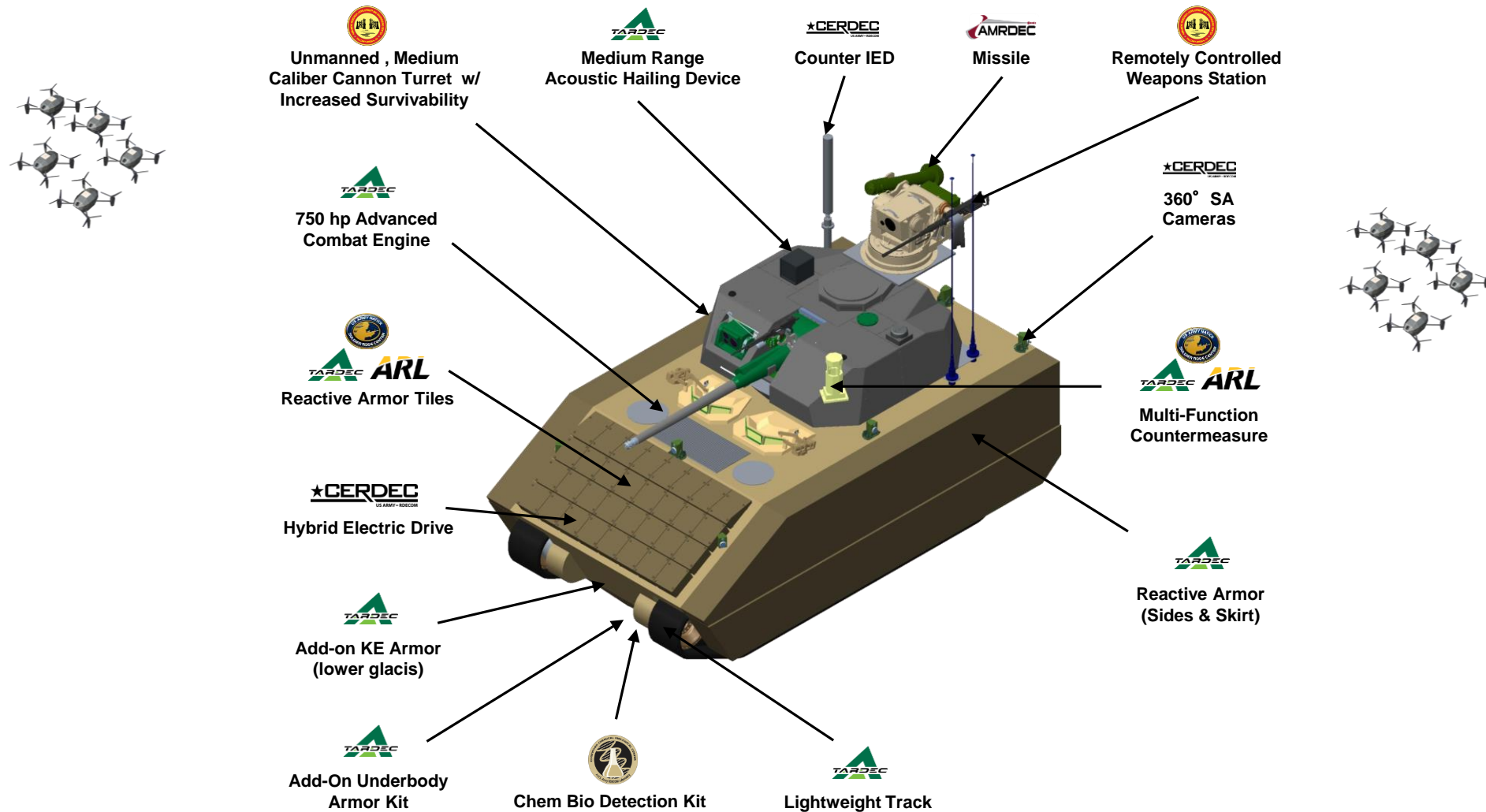
Infantry Fighting Vehicles of the Future ... Some Thoughts



Weight	40 ton class	60 ton class	23.9 ton Early Entry (EE) - 37.1 ton Campaign
Crew/ Dismounts	3 crew / 7 dismounts	3 crew / 9 dismounts	2 crew / 6 dismounts per vehicle
Transportability	2 per C-17 (RORO - Reduced range)	1 per C-17	2 per C-17 (RORO - Full Range air drop)

Combat vehicle prototyping will inform design

Infantry Fighting Vehicles of the Future ... Some Thoughts



Combat vehicle prototyping will inform design

Space

Cyberspace

Air

Arctic

Mountains

Desert

Beach

Land

Sea

Jungle

Rivers

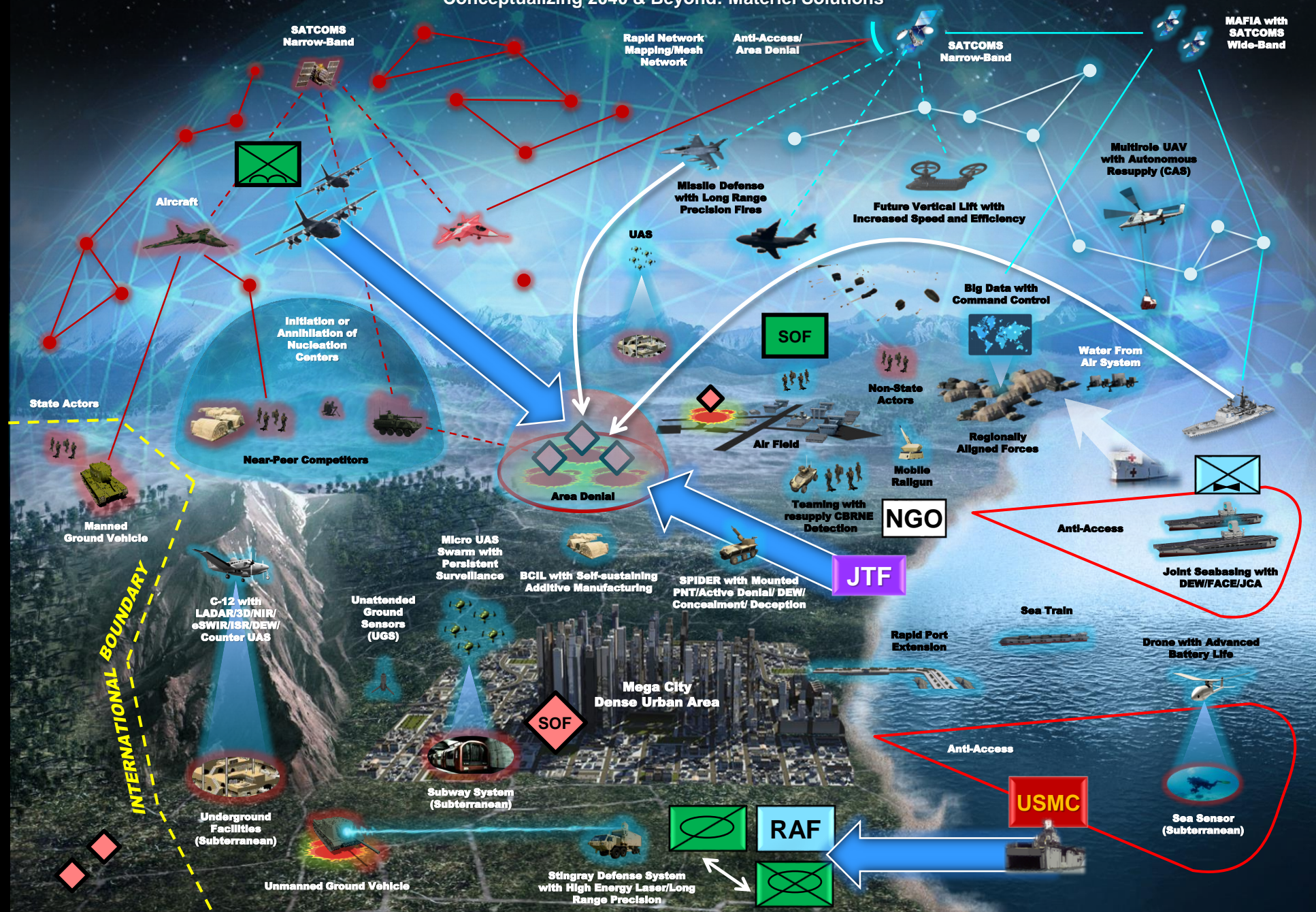
Maritime

Open Land



Win in a Complex World

Conceptualizing 2040 & Beyond: Materiel Solutions



Potential S&T Collaboration Areas

- Ultra Reliable Designs
- Biotechnology
- Cyber Warfare
- Soldier Portable Power
- Electronic Warfare
- Advanced Prototyping
- Nanotechnology
- Quantum Physics
- Textile Technologies
- Neural Networks
- Autonomous Systems



Partnerships promote innovation and interoperability

Army Research Laboratory Open Campus Initiative

Piloting a New Laboratory Business Model



Open Campus Website: <http://www.arl.army.mil/opencampus/>

Innovative partnerships to support the Nation

