



Force 2025 and Beyond

The U.S. Army's Holistic Modernization Strategy

We need an Army that can be adaptive, innovative, exploits the initiative and can solve problems in many different ways.

General Raymond T. Odierno
Chief of Staff, Army¹

Introduction

The United States Army—the nation's foundational force—has defended America's freedom, prosperity and way of life for more than 239 years. Today the Army is the strategic linchpin of national defense and provides a seamless continuum of options for senior civilian and military leadership alike. The Total Army (active, Guard, Reserve), as one part of the joint force, provides a significant amount of enduring capabilities to support combatant commanders' efforts to prevent conflict, shape the security environment and win in a complex world.

Soldiers and their leaders continue to perform in an outstanding manner after more than 13 years of sustained military engagements against determined enemies, but now they face an even greater threat: the unknown and the unknowable. Today's security environment is defined by its complexity, unpredictability and the increasing momentum of human interaction. Threats from state and nonstate actors, as well as humanitarian crises such as the current Ebola disease outbreak in Africa, demand an Army that possesses a wide variety of adaptive, innovative, robust and resilient capabilities. Moreover, as technology proliferates, enemies will also have greater access to weapons of mass destruction (WMDs) and sophisticated technical capabilities that will negate the Army's overmatch on the battlefield of tomorrow. The recent Deep Futures war game Unified Quest projected that in 30 years the U.S. military will have to be ready to deal with an operational environment consisting of:

- megacities—complex terrain that reduces U.S. advantages;
- resource competition—especially in megacities with reduced essential services; and
- physical and cognitive augmentation—the use of bio- and nanotechnology by adversaries to enhance performance that may go beyond ethical boundaries.



This dynamic set of conditions creates the need for the Army to define a more capable, adaptive future force that thinks, plans and operates differently.

The Army of the future—globally responsive and regionally engaged—must be leaner and more expeditionary and must contain greater lethality, agility and adaptability. Its Soldiers and leaders must be innovative, adaptive and critical problem-solvers. Army forces must excel across the entire range of military operations and adapt rapidly for unconventional missions. When conflict occurs, the Army, as part of a joint or multinational force, needs to dominate the environment, sustain multiple operations and win decisively. Developing an Army with these capabilities helps to avert miscalculation by potential adversaries despite the pending reduction in force size.

At its core, the Army is people. The key to success will be to continually develop future leaders that can adapt strategy to address the unpredictable challenges of the future operational environment. **Success is tied to maintaining technological overmatch capabilities against likely antagonists; however, the Army is at risk of losing its current technological advantage.** To mitigate this risk, the Army has created a comprehensive, innovative modernization strategy called Force 2025 and Beyond. This strategy will improve

¹ Michelle Tan, "Many Missions, Fewer Soldiers," *Army Times* interview with General Raymond T. Odierno, 25 September 2014.



the ability to provide technologies in support of future operations. It will also streamline operational processes to produce a more adaptable, agile and effective Army Total Force. As General Dennis L. Via stated, “The Army must shape a force for the future that maintains a technological edge on the battlefield.”²

Background

The Department of Defense’s Better Buying Power 3.0 acquisition improvement initiative seeks to maintain the technological superiority of the U.S. military. It will focus on innovation and long-range research and development efforts. The Army’s vision for the future—Force 2025 and Beyond—is in keeping with this DoD initiative. Objectives include:

- making Army formations more expeditionary and producing a leaner force;
- retaining or improving current levels of tactical mobility, lethality and protection; and
- reducing the required sustainment footprint in austere environments.

Successful achievement of these objectives will depend upon a vibrant and well-funded Army research, development and engineering (RD&E) activity consisting of requirements developed by the U.S. Army Training and Doctrine Command (TRADOC); and the Science and Technology (S&T) Enterprise led by the Assistant Secretary of the Army for Acquisition, Logistics and Technology—ASA(ALT). The new Army Operating Concept that describes required capabilities and identifies science and technology focus areas will guide TRADOC-developed requirements, as the S&T Enterprise helps the Army optimize its capabilities and minimize risk.³

The Science and Technology Enterprise

Through Force 2025 and Beyond, TRADOC identifies warfighting challenges to focus S&T efforts toward maintaining overmatch against potential adversaries. The S&T

Enterprise develops the capabilities that address these warfighting challenges, thus allowing the Army to maintain an overmatch against potential adversaries in the far term. As the Army faces a reduction in resources in the coming years, focused strategic investments in the S&T Enterprise can help inform affordable requirements, minimize Program of Record (POR) risks, optimize capabilities and address life-cycle issues. The Honorable Heidi Shyu, Assistant Secretary of the Army for Acquisition, Logistics and Technology, or ASA(ALT), has directed the Program Executive Offices and the S&T community to develop materiel strategies that focus on near, intermediate and long-term capability gaps. “To anticipate tomorrow’s threats,” she says, “the Army is leveraging critical-enabling technologies in current and future Programs of Record. In addition, the current force’s ongoing materiel superiority requires constant vigilance to identify future technology insertion opportunities.”⁴

The S&T Enterprise works with academia, industry, international and other government partners to plan and synchronize the development and the transition of those capabilities into acquisition PORs and ultimately fielded systems. This early collaboration between the S&T Enterprise and the

Army Materiel Command and the Army Science and Technology Enterprise

Army Materiel Command (AMC) coordinates science and technology (S&T) across the full spectrum of Army operations, including execution of a \$1.6 billion S&T portfolio that represents almost 75 percent of the Army’s annual S&T investment. Within the complete portfolio, investments are separated into six focused areas: Air; Ground; Soldier; Command, Control, Communications and Intelligence (C3I); Lethality; and Basic Research.

This portfolio management construct supports total lifecycle decisions for technologies and enables an approach that helps mitigate risk within the research and development process. To support investments within each of these areas, AMC has developed a series of core competencies within its six development centers and the Army’s corporate laboratory. By focusing them on a set of core competencies, AMC is building unique communities of excellence with the facilities and expertise to deliver the technology needed to support the future force.

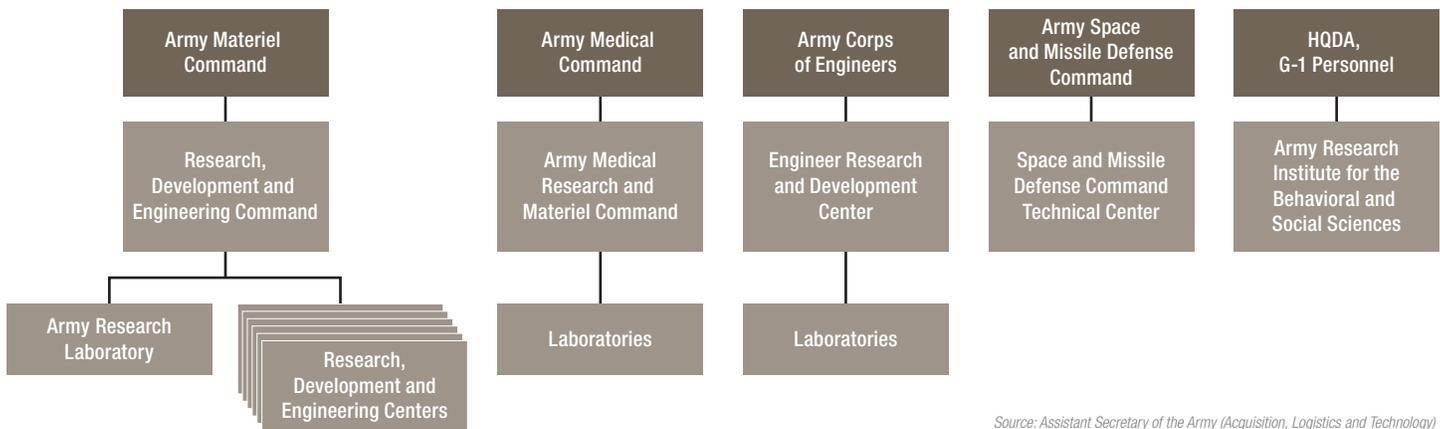
In an age where information is readily accessible, a key component of building a modern and efficient Research, Development & Engineering (RD&E) activity will be the establishment of a virtual collaborative environment or “virtual lab.” This virtual lab will facilitate the sharing of information and data among the research and development centers of excellence as well as with other components of the RD&E activity; this will foster innovation, allow for enhanced modeling and simulation capabilities and support the rapid prototyping and fielding of solutions.

² General Dennis Via, “Materiel Command Shoots for Technological Edge,” *ARMY*, 7 March 2014.

³ Department of the Army, “Army Operating Concept: Winning in a Complex World,” TRADOC Pamphlet 525-3-1, 31 October 2014.

⁴ HON Heidi Shyu, ASA(ALT), Arlington, VA, 23 December 2014.

The U.S. Army Science and Technology Enterprise



Source: Assistant Secretary of the Army (Acquisition, Logistics and Technology)

acquisition community enables faster fielding and also fosters understanding and improvement in the overall lifecycle costs of systems. These efforts are aligned within the Long-range Investment Requirements Analysis (LIRA) process to ensure synchronization, facilitate technology transition, ensure lifecycle planning and reduce resource redundancies. The technologies themselves must also be strategically aligned and timed to deliver capabilities that provide the required operational advantage.

The S&T Enterprise consists of the Research, Development and Engineering Command within the Army Materiel Command (AMC); the Medical Research and Materiel Command within the Medical Command; the Engineering Research Development Center within the U.S. Army Corps of Engineers; the Space and Missile Defense Command–Technical Center within the U.S. Army Forces Strategic Command/Space and Missile Defense Command; and the Army Research Institute for the Behavioral and Social Sciences within the Headquarters Department of the Army, G-1, Deputy Chief of Staff for Personnel. These organizations are on the front lines of enabling an Army transformation through updated business practices, like the LIRA, that will effectively align technology development with acquisition opportunities and Army warfighter needs, creating the foundation for prioritizing investments across portfolios of technologies. **All of the Army’s laboratories and centers, large and small, are engaged with academia, private industry, international partners and other government organizations seeking to leverage technology and capability wherever it can be found for the benefit of the Army.** The Army’s S&T program is organized into eight investment portfolios that address challenges across six Army-wide capability areas—Soldier/Squad; Air; Ground Maneuver; Command, Control, Communications and Intelligence (C3I); Lethality; and Medical—and two S&T enabling areas (Basic Research and Innovation Enablers).

With the increasing use of commercially or cooperatively developed products and the rapid progression of technology, the Army’s technological advantage will reside with its

U.S. Army Pacific Seeks Technologies to Enhance Force Protection⁵

U.S. Army Pacific (USARPAC) is looking for technologies and equipment that will assist force projection in an area of responsibility that includes half the world’s surface area, its commanding general says.

U.S. Pacific Command (USPACOM) is responsible for an area extending from the West Coast of the United States to India—with more than half the world’s people and half the planet’s surface area but only 17 percent of its dry land. Nevertheless, USARPAC constitutes the organization with the largest number of personnel in USPACOM, with units based in Washington, Alaska, Hawaii, South Korea and Japan.

To implement the national strategy to work with partner nations in handling man-made and natural crises, USARPAC needs to engage with numerous militaries and work around language barriers and information technology interoperability issues, USARPAC commander General Vincent Brooks told a press briefing 13 October at the Association of the United States Army’s Annual Meeting and Exposition.

What is needed, he said, are “technologies that help us project ourselves, whether it’s lighter-weight physical technologies, different kinds of composite materials or things that provide different protection, better climate control or simply transport, like ships.”

ability to accommodate the next major advancement, as it becomes available, by designing systems based around open architectures and common interfaces.

As part of the globalization of technology, competition for a modern workforce continues to increase. As a result, it is vital that the Army focus not only on its investments in technologies but also on its technical workforce. **Without the ability to recruit, develop and retain personnel with the right skill sets, the Army will be in danger of being a step behind the next wave of technology.** To support the development of the complex interoperable systems, the Army will have to recruit subject-matter experts (SMEs) with a depth

⁵ John M. Doyle, “U.S. Army Pacific Seeks Technologies to Enhance Force Projection,” *Aviation Week*, 14 October 2014.

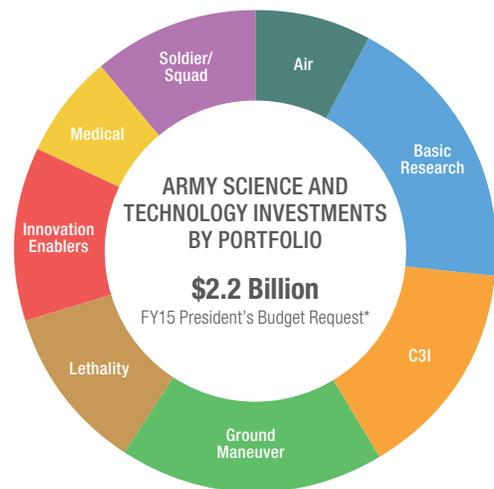
of experience in a specific field as well as SMEs with experience that cuts across a variety of fields. Systems Engineering is becoming even more important as senior leadership seeks to move toward open architecture system concepts. The ability to develop a foundational architecture that can adapt and adopt emerging capability without having to be redesigned will be critical to the future of the Army—impacting both the affordability and agility of its systems. There are currently several science, technology, engineering and mathematics (STEM) educational outreach and career development programs designed to increase awareness, understanding and interest in technical fields within the Army. These programs are vital to fostering the next generation of researchers and, as a consequence, the next generation of research and technology.

Providing Technologies for the Future Force

To maintain dominance in light of a future of unknown and often rapid changes, the Army must posture itself to proactively innovate; efficiently identify technologies; effectively develop solutions; and responsively deliver capabilities to the force. This enhances the service’s role not only as a developer of technology but also as an intelligent consumer poised to leverage technologies and access capabilities from other sources as soon as they become operationally relevant and economically viable.

With many of the technologies and capabilities that will be fielded by 2025 currently under development, TRADOC and the user communities continue to play a critical role by producing future warfighting concepts. These concepts will be the basis for prioritizing the materiel investments to provide the suite of technologies that delivers the best value to the force. For the expeditionary and regionally aligned future force, there will be a number of potential capabilities, including but not limited to:

- **Future Vertical Lift/Joint Multi-Role Technology Demonstrator (FVL/JMR TD).** This is a faster (>230 knots) rotorcraft platform with increased range and payload that can also operate at higher temperatures and altitudes. Such an aircraft could potentially enable the units to self-deploy and would allow the Army to replace 80 percent of its aging rotorcraft fleet.
- **Additive Manufacturing.** Already being used in Afghanistan, this technology (otherwise known as 3-D printing) will likely transform many aspects of Army clothing manufacturing, ordinance production, medical treatment and food production.
- **High-Energy Laser (HEL) Mobile Demonstrator (MD).** This is a directed-energy capability to complement conventional offensive and defensive weapons at a lower cost-per-shot than current systems. Doing so will reduce the need to stockpile ordinance. The HEL MD will have the capability to engage and defeat rockets, artillery and mortars (RAM). It will be able to counter intelligence, surveillance and reconnaissance (ISR) platforms and unmanned aerial vehicles (UAVs) as well.

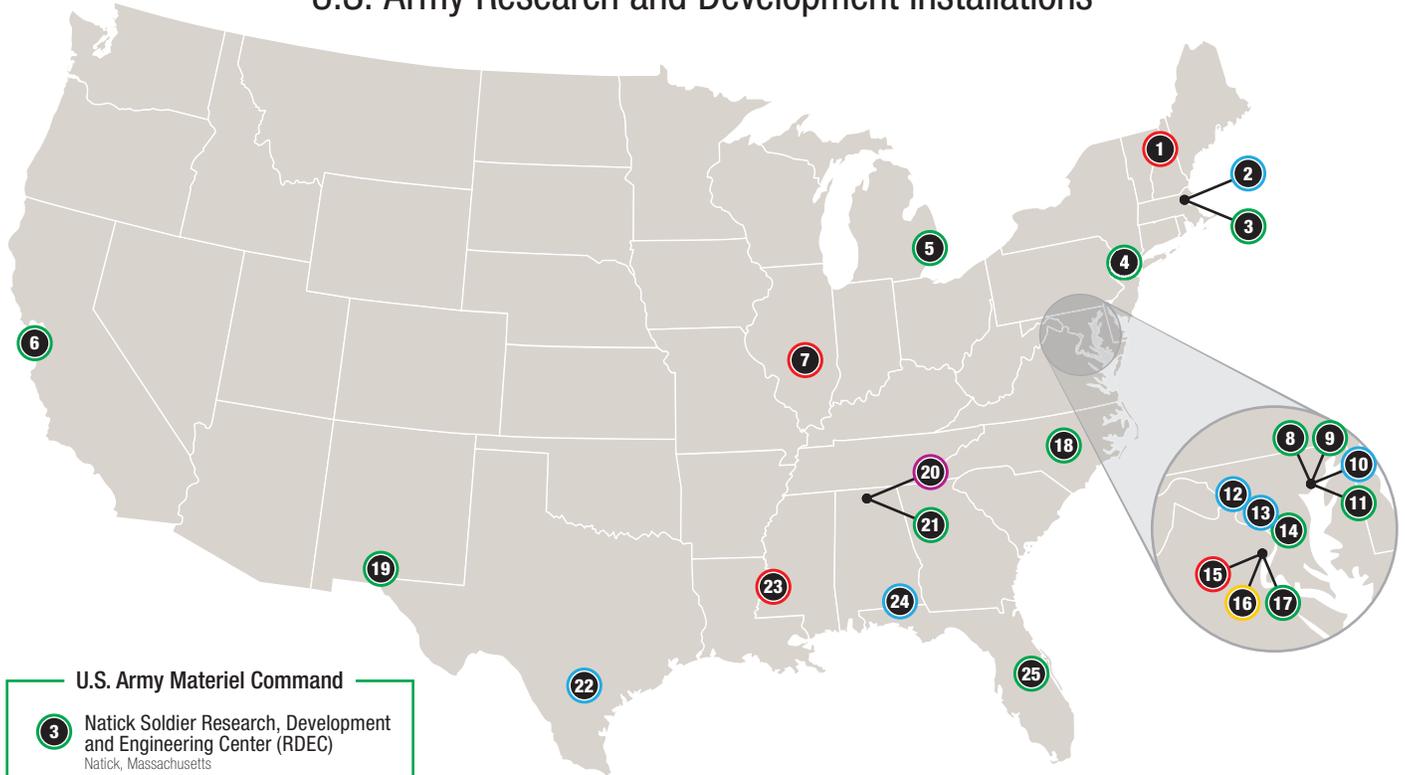


- 19% Basic Research**
Neuroscience; Network Science; Materials Science; Autonomy
- 18% Ground Maneuver**
Combat/Tactical Ground Platforms/Survivability; Unmanned Ground Systems; Austere Energy; Power and Energy
- 15% Command, Control, Communications and Intelligence (C3I)**
Secure Communications-on-the-move; Cyber/Electronic Warfare; Sensors
- 12% Innovation Enablers**
High-Performance Computing; Environmental Protection; Base Protection; Studies
- 11% Lethality**
Offensive/Defensive Kinetic (Guns, Missiles) greater than .50 calibre; Directed Energy (High-Energy Laser) Weapons
- 11% Soldier/Squad**
Soldier Survivability Equipment; Human Dimension/Systems; Power and Energy; Soldier Weapons; Training
- 8% Air**
Advanced Air Vehicles; Unmanned Aerial Systems; Manned/Unmanned Teaming
- 7% Medical**
Combat Casualty Care; Infectious Disease Mitigation; Clinical/Rehabilitative Medicine

* Figures for S&T funding from the 2015 Defense Appropriations bill were not available at time of publication.
Source: Assistant Secretary of the Army (Acquisition, Logistics and Technology)

- **Modular Active Protection Systems (MAPS).** Instead of developing a complete solution for a particular vehicle or threat scenario, senior leadership is seeking to develop a threat-cueing technology that can alert a crew to a rocket-propelled grenade (RPG), an antitank guided missile (ATGM) launch and tank or recoilless rifle fire and provide azimuth and elevation response to those threats. The associated sensors and countermeasures would be capable of installation on a variety of ground vehicles and be compatible with the controller, allow-

U.S. Army Research and Development Installations



U.S. Army Materiel Command

- 3** Natick Soldier Research, Development and Engineering Center (RDEC)
Natick, Massachusetts
- 4** Armament RDEC
Picatinny Arsenal, New Jersey
- 5** Tank Automotive RDEC
Warren, Michigan
- 6** Aviation and Missile RDEC – Army Aeroflightdynamics Directorate
Moffett Field, California
- 8** Army Research Laboratory (ARL)
Aberdeen Proving Ground, Maryland
- 9** Edgewood Chemical Biological Center
Aberdeen Proving Ground, Maryland
- 11** Communications Electronics RDEC
Aberdeen Proving Ground, Maryland
- 14** Army Research Laboratory
Adelphi, Maryland
- 17** Communications Electronics RDEC
Fort Belvoir, Virginia
- 18** Army Research Office
Durham, North Carolina
- 19** ARL – Battlefield Environments and Survivability Elements
White Sands Missile Range, New Mexico
- 21** Aviation and Missile RDEC
Redstone Arsenal, Alabama
- 25** ARL – Simulation and Training Technology Center
Orlando, Florida

U.S. Army Space and Missile Defense Command

- 20** Space and Missile Defense Command Technical Center
Redstone Arsenal, Alabama

Headquarters, Department of the Army, G-1

- 16** Army Research Institute for the Behavioral and Social Sciences
Fort Belvoir, Virginia

U.S. Army Corps of Engineers

- 1** Cold Regions Research and Engineering Laboratory
Hanover, New Hampshire
- 7** Construction Engineering Research Laboratory
Champaign, Illinois
- 15** Army Geospatial Center
Alexandria, Virginia
- 23** Engineer Research and Development Center
Vicksburg, Mississippi
Coastal and Hydraulics Lab
Environmental Lab
Geotechnical and Structures Lab
Information Technology Lab

U.S. Army Medical Command

- 2** Research Institute of Environmental Medicine
Natick, Massachusetts
- 10** Research Institute of Chemical Defense
Aberdeen Proving Ground, Maryland
- 12** Research Institute of Infectious Disease
Frederick, Maryland
- 13** Walter Reed Army Institute of Research
Silver Spring, Maryland
- 22** Institute of Surgical Research
Fort Sam Houston, Texas
- 24** Aeromedical Research Laboratory
Fort Rucker, Alabama

Source: U.S. Army Materiel Command, Assistant Secretary of the Army (Acquisition, Logistics and Technology)

ing different sensor and countermeasure solutions to be deployed on present and future vehicles.

- **Alternative Sources of Water.** Capabilities to purify and reuse water, as well as generating water on location, are emerging. Currently, each gallon of fresh water consumed creates an equivalent amount of waste water that must be brought out or dealt with onsite. Various

technologies that purify water to reduce this logistical requirement and streamline sustainment have potential.

- **Medical.** Ongoing research efforts address multiple threats to Soldiers' health and readiness. Research includes work in improved infectious disease prevention and treatment, enhanced combat casualty care and optimization of health and performance through health/



performance status monitoring and tailored/individualized health and performance enhancement.

- **Rapid Wound Cleansing System.** Rapid wound cleansing is necessary to avoid wound sepsis (infection) and achieve optimal healing. This wound cleansing system will replace the current heavier system, reducing the amount of fluid and the weight a medic carries without compromising the quality of medical care. Replacing the current system will reduce the required volume from 12 liters to less than 2 liters.
- **Regenerative Medicine for Wound Healing.** Wound injury treatments for military personnel are being developed using combinations of products containing hydrogel biomaterials, tunable topical release of antimicrobial/antibiotics, and using the patient's own stem cells for inducing active tissue regeneration. This combination strategy will not only enhance healing through promoting blood vessel growth and granulation (new connective tissue and tiny blood vessels that form on the surface of a wound) but also will limit the onset of opportunistic wound infections.
- **Autonomous Aerial Resupply.** Although in its early stages, the ability to use autonomous systems to conduct aerial resupply would enable these unmanned systems to optimize and adapt behavior to complete the mission rather than flying only preplanned routes that are easier to counter.
- **Future Advanced Squad Technologies (FAST).** To improve the lethal effects in small-arms capabilities, the Army is looking at ways to accelerate the development of enabling technologies required to extend individual Soldier engagement ranges and maintain or increase squad lethality overmatch.
- **Soldier Protection Initiatives.** Force protection programs, including an active eyewear system that will provide vision enhancement while protecting against ballistic fragmentation and lasers, are in development.⁶ The technology for a future head protection system called "HEaDS UP" could enable Soldiers to carry more equipment like radios or night-vision goggles on their helmets without adding weight to neck or head.⁷

Delivering the Future Force

The Force 2025 and Beyond initiative is an innovative, holistic modernization strategy through which



the Army intends not only to account for past lessons learned but also to retain the technological overmatch it currently enjoys. This initiative is revising the Army's operations to refine warfighting concepts, optimize human performance and improve performance and reliability of systems to ensure the development of a leaner, more expeditionary and lethal force. To do so means the Army must prevent overmatch through 2025 and set conditions for fundamental change by 2030–2040.

The senior leadership is continuing to focus on investments in recruiting, developing and retaining the technical workforce needed to stay ahead of the next wave of technology. **Sustaining investments in the technical workforce is paramount. Doing so will ensure that emergent capabilities can be easily adapted as the Army incorporates open-architecture systems.** However, sequestration could undermine these efforts. According to ASA(ALT) Heidi Shyu, the attrition rate of skilled workers will continue to rise if sequestration is not repealed before it restarts in Fiscal Year 2016.⁸

The Army is also streamlining its overall RD&E activity to refine the determination of requirements and synchronize innovation to support the future force. The S&T Enterprise is central to this role. In this respect as well, the indiscriminate budget cuts triggered by the sequestration law have jeopardized the Army's future, despite the Army's best efforts to accelerate divestment of old equipment to save on sustainment costs. Given the uncertainty of the future operational environment, it is imperative that the Army receive timely and predictable funding to enable delivery of promising technologies that will preclude overmatch by potential adversaries. No Soldier should be sent into harm's way without the best capability the nation can offer.

⁶ Jane Benson, "True Vision Aries: Natick Takes Protective Eyewear into the Future," *Soldier: Science & Engineering*, Summer 2014.

⁷ T'Jae Gibson, "Natick's 'HEaDS UP' Leads Way," *Soldier: Science & Engineering*, Summer 2014.

⁸ David Vergun, "Shyu: Army modernization entering 'death spiral,'" *Army News Service*, 15 October 2014, <http://www.army.mil/article/136214>.