

Science and Technology

The Army Science and Technology (S&T) strategy supports the Army’s goals to restore balance between current and future demands by providing new technologies to enhance and modernize systems in the Current Force and to enable new capabilities in the Future Force. This strategy is enabled through a portfolio of investments, each providing different results in distinct timeframes.



Figure 1: Army S&T Strategy—Develop and mature technology to enable the Future Force while seeking to enhance the Current Force

These S&T investments include: far-term, funding basic research for discovery and understanding of phenomena; mid-term, funding applied research laboratory concept demonstrations; near-term, funding advanced technology development demonstrations in relevant environments outside the laboratory; manufacturing technology processes; and technology maturation, which addresses technologies that will expedite technology transition to programs of record. The technology demonstrations prove technology concepts and their military utility to inform the combat developments process and provide the acquisition community with evidence of technologies’ readiness to satisfy system requirements. This portfolio supports overseas contingency operations in three ways: 1) Soldiers benefit today from technologies that emerged from our past investments; 2) we exploit transition opportunities by accelerating mature technologies derived from ongoing S&T efforts; and 3) we leverage the expertise of our scientists and engineers to develop solutions to unforeseen problems encountered during current operations, such as armor applied to Mine Resistant Ambush Protected (MRAP) combat vehicles for enhanced protection from Rocket Propelled Grenades. The entire S&T program is adaptable and responsive to the Army Modernization Strategy.

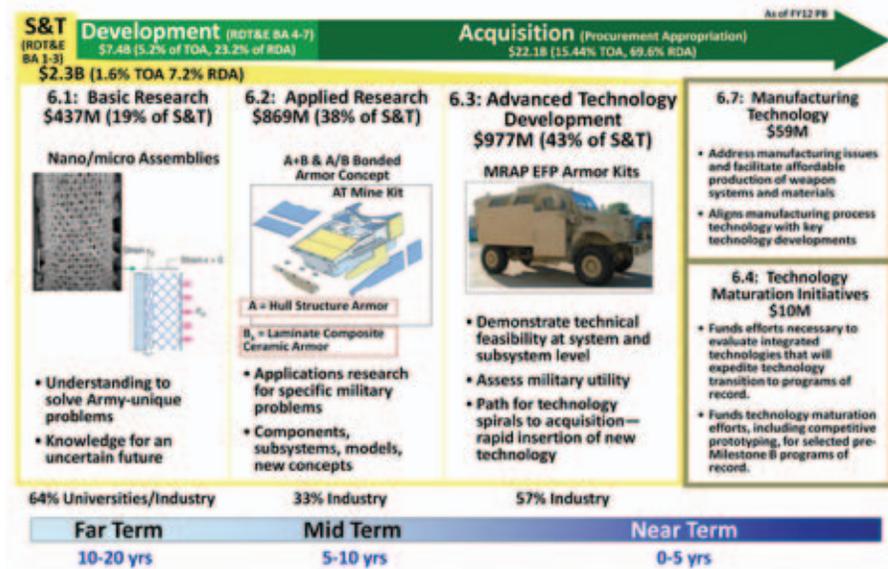


Figure 2: The S&T portfolio consists of five types of investments

FORCE PROTECTION

Advanced Aircraft Survivability

The Advanced Aircraft Survivability effort develops and demonstrates an integrated, multispectral (ultraviolet, infrared, acoustic), distributed aperture aircraft survivability solution to simultaneously detect, identify, and cue integrated countermeasures against current operational and emerging Hostile Fire and Man Portable Air Defense (MANPAD) technology threats. Elements of this program include: improved missile and small arms fire detection sensors; lightweight laser countermeasure for MANPAD missiles and integrated visual laser dazzling of small arms threats; lightweight beam directors; and closed-loop threat identification techniques.

Threat Detection and Neutralization for Route Clearance

This effort demonstrates and matures threat/mine detection and neutralization capabilities to address a broader spectrum of in-road threats for route clearance vehicles. This will also integrate improvised explosive device/mine detection and neutralization technologies, communications, and electronic warfare equipment to provide an effective system concept of operations for route clearance. In addition, this will also provide multiple sensor technologies for effective standoff detection of deeply buried targets in primary and secondary roads and surface targets located on roadsides. The benefits to the Soldier include higher speed operations and rates of advance, as well as enhanced mobility and survivability of U.S. forces while clearing and maintaining travel routes in urban and rural areas.

Defense Against Rockets, Artillery, and Mortars (RAM) Technologies

Technology efforts in defense against RAM mature and demonstrate critical technologies to provide the mobile capability to defeat threats at extended ranges and across a 360-degree hemisphere. Technologies of missile and gun-launched interceptors to protect against RAM threats include the following subsystems developments: technical fire control node to process the decision logic for intercept; tracking and fire control radar to provide a precise location of the threat; launch systems; a guided missile-based interceptor with a high-explosive warhead; a miniature hit-to-kill missile-based interceptor; and a guided 50mm course-corrected projectile and gun.



Figure 3: Defense against RAM

INTELLIGENCE, SURVEILLANCE, RECONNAISSANCE

Advanced Common Sensor Payload

The Advanced Common Sensor Payload will provide day/night wide-area persistent imaging and enhanced reconnaissance, surveillance, and target acquisition capabilities for insertion into the common sensor payload (CSP). This CSP has a high-definition sensor and a dual-color, third-generation, forward-looking radar. This system will include “Step-Stare” software that provides persistent imaging scan modes to improve resolution and tiered data processing that adds onboard modules for enhanced data exploitation and compression to allow operation over extended-range and multipurpose data links. The payoff for the unmanned aircraft system will be a payload that provides persistent wide-area activity monitoring and enhanced capabilities to include target search at ID resolution, reduced operator workloads, and improved data exploitation.

Integrated Radio-frequency Operations Network (IRON) Symphony

IRON Symphony will define and develop a next-generation Army Electronic Warfare (EW) networking capability, based on an integrated and distributed EW framework, to enable the coordinated detection, geo-location, reporting, and engagement of multiple diverse threat waveforms. Most current EW systems are designed to mitigate a single threat waveform. Multiple threats force the development of multiple systems, resulting in a rapid escalation of interoperability and spectral de-confliction issues. The robust proliferation and simultaneous use of modern communication threats, as well as the complexity of the threat signals themselves, have created an environment where the use of individualized solutions is no longer feasible.

Flexible Display Initiative

The flexible display initiative develops flexible display technologies for affordable, lightweight, rugged, low-power, and reduced-volume displays in conjunction with the development of human factors parameters for systems utilizing flexible displays. Flexible displays have reduced weight and are inherently rugged with ultra-low power electro-optic technologies as compared to traditional liquid-crystal, glass-based displays. The development of displays on flexible substrates will enable novel applications that cannot be achieved by glass-based technologies (e.g., wearable and conformal for Soldier applications, conformal for vehicle and cockpit applications, and compact display that can be rolled out for multiuser applications).



Figure 4: Flexible display technology for Soldiers and vehicles

COMMAND, CONTROL, COMMUNICATIONS, AND COMPUTERS

Collaborative Battlespace Reasoning and Awareness (COBRA)

The COBRA initiative develops and demonstrates multiplatform, cross-community applications and software services that support the integration and synchronization of intelligence and operations functions through the design, development, and implementation of information interoperability, and through collaborative management and decision-support technologies. This technology also develops software techniques that will improve mission execution success by providing software to more tightly coupled operations and intelligence and to better facilitate collaboration. Research and development will be focused on mapping intelligence and geospatial information requirements to military tasks. This effort will make possible faster and higher-quality decision cycles and increased battle command unification through collaboration and real-time sharing, exploitation, and analysis to support the operational mission, tasks, and desired effects.

Multi-Access Cellular Extension (MACE)

The MACE effort is investigating adapting and connecting commercial-off-the-shelf (COTS) smartphone and cellular base station technology to a military network such as the Warfighter Information Network-Tactical (WIN-T) or the Joint Tactical Radio System. MACE inserts smartphone technologies into the tactical environment, applies appropriate security measures, and integrates them into military network operations' management capabilities. It will allow Soldiers to take full advantage of the mixed WiFi/cellular capabilities of the smartphone while maintaining interoperability with the military network. MACE technology will include a WiFi mesh networking application to allow groups of Soldiers with smartphones to automatically form into a local network when they are not able to connect to a cellular base station or WiFi hot spot on the military network, and then reconnect to the larger network when they come back within range. This will allow dismounted Soldiers to remain connected with each other when they lose connectivity with the tactical networks. MACE also seeks to improve Soldier position/location understanding by augmenting the GPS in COTS smartphones with radio frequency ranging to better adapt to GPS-challenged environments.

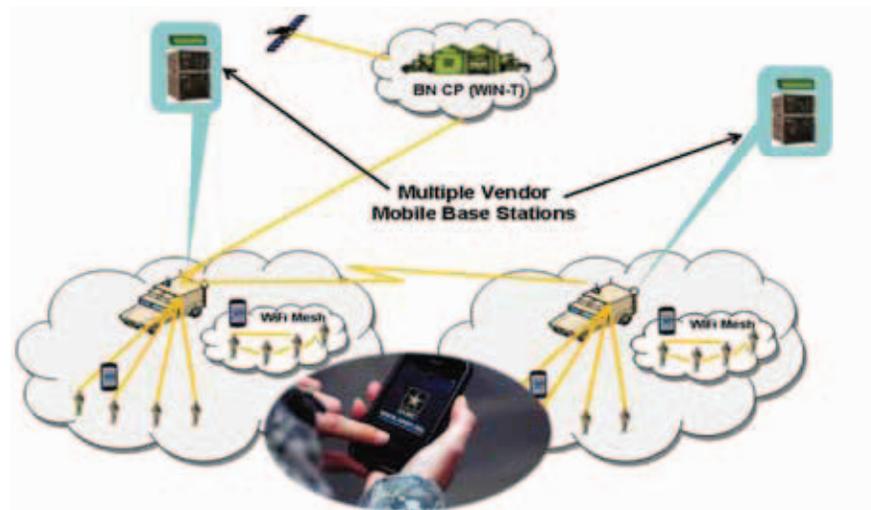


Figure 5: MACE

LETHALITY

Small Organic Precision Munitions

This effort demonstrates critical technologies for a 5-7lb Soldier-carried, guided, non-line-of-sight munition. The critical technologies demonstrated will improve target acquisition, increase lethality against soft targets, provide a secure data-link, and increase battery life. This technology will provide forward operating bases with improved situational awareness, lethality, and survivability against combatants on ridgelines or overhangs, snipers in close urban terrain, and insurgents placing improvised explosive devices, while reducing collateral damage/fratricide.



Figure 6: Small organic precision munitions

Medium Caliber Weapon and Ammunition

This effort demonstrates a more accurate medium caliber weapon and ammunition for extended range engagements, as well as design and demonstration of a simple, low-cost remote armament system. This effort provides an accurate medium caliber weapon system for stationary and fire on-the-move. It provides an airburst munition with integrated fuzing, warhead, and safe-and-arm for improved effects against personnel (behind walls and in the open) at extended ranges. The technology provides ground-up remote weapon system design and demonstration with accurate aiming, improved stabilization, fast slew rates, target handoff, and hunter/killer-capable lethal and non-lethal ammunition. For extended ranges, technology products will provide improved accuracy, eliminating small elevation errors, which create large miss distances.

Next-Generation Kinetic Energy Cartridge

This effort demonstrates a 120mm next-generation direct-fire advanced kinetic energy round capable of defeating current and future threat targets without a depleted uranium (DU) penetrator. This effort provides novel penetrator designs with new materials for the most difficult threat targets, and provides methodology to demonstrate the contribution of velocity design and materials to maintain current lethality with DU. Additionally, this technology provides penetration and lethality data and models of novel penetrator performance against advanced full-scale armor threat targets from ordnance velocity through hypervelocity impact, and also a potential replacement for DU at ordnance velocity.

MEDICAL

Advanced Transition Training Strategies for Post-Deployment: ArmySMART

This research documents the significant impact of combat on Soldier behavioral health and adjustment. It also focuses on developing and validating advanced unit-level training to reduce combat-related psychological problems. The in-depth training program, Army Stress Management and Resilience Training (ArmySMART), is designed to provide a systematic and effective behavioral health intervention for high-combat units. The training package incorporates an occupational health model specifically developed for Soldiers that leverages Soldier strengths, unit cohesion, leadership skills, and individual cognitive skill building. Additionally, this research included problems such as post-traumatic stress disorder symptoms, relationship problems, anger problems, and risk-taking behavior during the post-deployment resetting phase. Adjunct training is also being developed to target the management of intrusive deployment-related thoughts. Each training product is being tested using a randomized controlled trial to ensure training efficacy.

Detection and Treatment of Traumatic Brain Injury (TBI)

This technology is testing a candidate drug to treat TBI to determine its safety and effectiveness in 200 human subjects that have suffered TBI. It is estimated that 15 to 25 percent of all injuries in recent conflicts are to the head. TBI survivors often have physical and cognitive impairment, memory loss, and mood and personality disorders. There are currently no drugs to treat or reduce brain-related injuries.



Figure 7: Detection and treatment of TBI

Alternative Dengue Fever Vaccine Strategy

The objective of this effort is to develop a single vaccine that is effective against the four major types of dengue. This strategy should demonstrate human safety and provide initial data on the body's immune response. The current live-attenuated dengue virus vaccine in advanced development is suboptimal for rapid deployment since it uses three doses at 0, 3, and 12 months. A vaccine fitting this dosing schedule will meet the U.S. military Capability Development Document (CDD) threshold. Ideally, the time to protection could be achieved more rapidly (within 3 months per CDD). Successful completion will produce a vaccine strategy that will lead to a more rapid and complete protection from dengue infection.

Candidate Multivalent Vaccine Against HIV-1

The goal is to develop a Food and Drug Administration-licensed, globally effective, human immunodeficiency virus (HIV-1) vaccine to prevent HIV-1 infection in U.S. and allied Warfighters through the use of a multicomponent vaccine platform. The current program is focused on studying a range of vaccine candidates in an effort to identify and elicit the immune responses needed to protect humans from HIV and acquired immunodeficiency syndrome. These vaccine strategies are aimed at global protection, which could be tested in a broad spectrum of genetically diverse HIV epidemics worldwide. The current strategy is based on an attenuated viral vector, Modified Vaccinia Ankara, as the delivery vehicle of candidate vaccines into the human body. The objective is to demonstrate that these vaccines are safe for human subjects and capable of inducing an immune response that protects against HIV-1. Initial Phase 1 clinical trials conducted in CONUS and OCONUS sites showed that these vaccines are safe and immunogenic. Researchers are also working on a next-generation vaccine aimed to expand the breadth of protective immune responses by using mosaic HIV inserts in a prime-boost strategy in delivery vectors derived from different species.

Damage Control Resuscitation

This pursues the best combination and optimal use of alternatives to whole blood (e.g., plasma, red blood cells, blood-clotting agents) to prevent bleeding and maintain oxygen delivery and nutrients to tissue. These products will likely enhance survival of casualties after severe blood loss, which is the leading cause of death to injured Warfighters. Recent data from the battlefield suggests that blood-clotting disorders and immune system activation, which damage normal cellular metabolic processes, commonly occur in severely injured patients. Therefore, a priority is to maintain blood-clotting capability and oxygen and nutrient delivery to tissues by using the best resuscitation products that can be administered at far-forward locations.



Figure 8: Damage control resuscitation

UNMANNED SYSTEMS

Safe Operations of Unmanned Systems for Reconnaissance in Complex Environments

This effort develops, integrates, and demonstrates robust robotic technologies required for Future Modular Force unmanned systems. This technology will advance the state-of-the-art in perception and control technologies to permit unmanned systems to autonomously conduct missions in populated, dynamic urban environments while adapting to changing conditions; develop initial tactical/mission behavior technologies to enable a group of heterogeneous unmanned systems to maneuver in collaboration with mounted and dismounted forces; optimize Soldier operation of unmanned systems; and provide improved situational awareness for enhanced survivability. Modeling and simulation will be used to develop, test, and evaluate the unmanned systems technologies (e.g., tactical behaviors and perception algorithms). Test bed platforms will be integrated with the software and associated hardware developed under this program, as well as appropriate mission modules, to support Warfighter experiments in a militarily significant environment.



Figure 9: Safe operation of unmanned systems for reconnaissance in complex environments

SOLDIER SYSTEMS

Soldier Planning Interfaces and Networked Electronics

This initiative develops a government-owned, Soldier-borne electronic equipment architecture that incorporates a National Security Agency-approved wireless personal area network subsystem. The Soldier Planning Interfaces and Networked Electronics (SPINE) reduces the Soldier-borne footprint and electronics system weight by 30 percent through the loss of wires and connectors. The wireless network will be powered by a conformal battery currently under development that increases power by 50 percent for a 24-hour period. This technology utilizes emerging software services to enable Soldier connectivity and data exchange to current and future tactical radio networks and battle command systems. Throughout this effort, capability demonstrations are conducted at the Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance On-The-Move test bed at Ft. Dix, NJ, to monitor progress.



Figure 10: SPINE

Helmet Electronics and Display System-Upgradeable Protection (HEADS-UP)

The purpose of HEADS-UP is to design and demonstrate a headgear system for mounted and dismounted Soldiers, which can provide tailored protection and capabilities for a variety of missions. This effort provides a head, face, and neck protection system incorporating modular, upgradeable protection to include traumatic brain injury; integrated sensor inputs; and optimized display hardware and software. Products include tailorable ballistic/blast protection; MOS-common mounting platform for sensors; tailorable Chemical, Biological, Radiological, and Nuclear protection (snap-on); and increased Soldier visual and audio data representation. Benefits to the Soldier include reduced weight for equivalent protection, small increased weight for significantly increased capabilities, and increased situational awareness in all environmental and obscurant conditions without sacrificing mobility and agility.

Reducing Soldier and Small Combat Unit Load

The objective of this effort is to understand and employ a holistic approach to solve the Soldier and Small Combat Unit physical and cognitive load problem. This effort provides representative physical and cognitive load baselines—the art/science of the possible for load reductions when considered in a holistic manner. This effort will also deliver advanced mission-planning tools to enable individual and/or unit-level tradeoffs, which have the potential to make a difference in Soldier load. Benefits to the Soldier include improved Small Unit mobility and endurance, as well as improved Small Unit cognitive performance, resulting in enhanced mission performance.

AVIATION

Advanced Rotary Wing Vehicle Technology

This effort develops and demonstrates transformational vertical lift technology-enabled capabilities for the next generation of joint rotorcraft, addressing operational capability gaps for aviation along with reduced cost of ownership. This effort will result in a flying Technology Demonstrator that provides enhanced operational efficiencies, such as reduced fuel burn rates, more responsive (faster) operating speeds, extended unrefueled range (longer reach), and increased high/hot time-on-target. It will provide enhanced platform survivability with reduced signatures and increased ballistic protection. Benefits to the Soldier include increased range and on-station time to deliver troops, weapons, and sensors on target, and increased Soldier survivability.



Figure 11: Advanced rotary wing vehicle technology

LOGISTICS

Advanced Affordable Engine Technology

This technology will develop a 3,000 horsepower gas turbine engine for improved operational capability for Blackhawk, Apache, and other Future Force rotorcraft. Target goals include a 25-percent reduction in specific fuel consumption, a 65-percent increase in horsepower-to-weight ratio, a 35-percent reduction in operation and support cost, and a 20-percent improvement in design life. This demonstration provides for significant increases in rotorcraft range and/or payload capability while reducing logistical burden. Upon completion of the S&T effort, this technology will transition to the Program Executive Office Aviation Improved Turbine Engine Program to upgrade the Blackhawk fleet.

Transformational Vehicle Management System

The objective of the Transformational Vehicle Management System is to allow Soldiers to conduct safe aviation missions in high task-loaded environments and in urban/complex terrain conditions by exploiting Full Authority Control Systems and active control technologies in legacy upgrades and new platform configuration. This effort will result in handling quality requirements and integrated control system concepts for legacy upgrades, multirole, and heavy-lift. It will provide simulation and control methods and tools for evolving manned and unmanned aerial vehicle (UAV) rotorcraft configurations, as well as Guidance-Navigation-Control technologies for Autonomous Flight Operations in urban and/or teaming environments. Potential benefits include reduced pilot workload and improved mission task performance for all-weather multimission operations; reduced development costs and design-cycle time; and technologies for UAV rotorcraft urban operations and teaming.



Figure 12: Advanced affordable engine technology

BASIC RESEARCH



Figure 13: Basic research investments

Basic research investments are a critical hedge in acquiring new knowledge in areas that hold great promise in advancing new and technically challenging Army capabilities and concepts to enable revolutionary advances and paradigm-shifting future operational capabilities. Areas of emerging interest and focus in basic research are autonomous systems, biotechnology, immersive technology, materials modeling, nanotechnology, network science, neuroscience, and quantum effects. Investment in basic research within the Army provides insurance against an uncertain future and guards against technological surprise. And if we are successful, these investments will make it possible to conduct ever more complex military operations, with greater speed and precision, to devastate any adversary on any battlefield. The following is a brief summary of the areas of investment, the synergy among them, and some of the capabilities they may provide.

Autonomous Systems—Extending the operational effectiveness of Soldiers through robotic systems

A major military objective is to totally frustrate and defeat our adversaries across a wide spectrum of conflicts while dramatically increasing the survivability of our Soldiers by keeping them out of harm's way. Autonomous systems of extraordinary capability can fulfill this objective; however, they must be completely safe and secure while operating in highly complex operational environments. Achieving such levels of capability will require significant investments in highly sophisticated sense, response, and processing systems approaching that of biological systems; major advances in artificial intelligence; the development of intelligent agents approaching human performance levels; and advances in machine learning, swarming, and actuation and control.

Biotechnology—Leveraging four billion years of evolution

The increasing importance and demands for wide-area persistent surveillance create significant challenges for sensor systems, real-time processing of vast amounts of data, the real-time interpretation of information for decision making, and power and energy requirements to support such demanding systems. Through four billion years of evolution, biological systems have engineered solutions to some of these challenges. We seek to leverage research in these areas for improving the performance of our Soldiers. Major investments in this area through reverse engineering will lead to totally new sensing systems, new ways for the rapid processing of data into information, the development of novel sense and response systems, and biologically inspired power and energy solutions.

Immersive Technology—The path to virtual reality training

The evolving threat environment continues to put increasing demands on the diversity and effectiveness of Soldier skills. To meet these demands, superior training tools and methods are needed. Virtual worlds can provide this capability; however, we are currently at primitive stages in their realization. With advances in computational processing and steady progress in understanding the brain's "software" comes the possibility of creating highly realistic virtual training environments inhabited by humanlike avatars. Such environments will provide a paradigm shift in the way we provide training, while achieving low-cost, safe, low-environmental impact, highly variable simulation environments for the future training of our Soldiers.

Materials Modeling—Atomic to the continuum research

Materials modeling research develops fundamental scientific principles across scales—from the atomic to the continuum—and develops underpinning, cross-cutting, and transferrable physics-based modeling capabilities. Research focuses on two-way multiscale modeling for predicting performance and designing materials; investigating analytical and theoretical analyses to effectively define the interface physics across length scales; advancing experimental capabilities for verification and validation of multiscale physics; and modeling and strategies for the synthesis of high-loading rate-tolerant materials. The intent is to provide the Army with next-generation multifunctional materials for ballistic and electronic applications, lightweight vehicle and facility protection, and energy storage and electronic devices, and to provide new materials to address the extreme challenges associated with understanding and modeling materials subject to Army operational environments. This research supports the development of computational tools, software, and new methods for material characterization to make the process of discovery and development of advanced materials faster, less expensive, and more predictable.

Nanotechnology—Dramatically changing our ability to manufacture new material by design

The last century was dominated by advances in the physical sciences through the discovery of the atom, its structure, and the laws that govern its behavior. This century will be dominated by the complex world of biology and nanoscience whose mysteries will be unraveled by our understanding of systems of atoms and molecules. Nanotechnology is the manipulation of matter on a near-atomic scale to produce new structures, materials, and devices. Nanotechnology research makes it possible to explore the emerging biotech field and dramatically change our capability in creating new materials by design. This technology has the ability to transform many industries in discovering and creating new materials with properties that will revolutionize military technology and make Soldiers less vulnerable to the enemy and to environmental threats. Research in nanoscale technologies is growing rapidly worldwide. By 2015, the National Science Foundation estimates that nanotechnology will have a one trillion dollar impact on the global economy and employ two million workers, one million of whom may be in the United States.

Network Science—Managing complex military operations with greater speed and precision

Networks tie together the following: highly distributed sensor systems for reconnaissance and surveillance, information for decision making, Soldiers, and the execution of fast distributed precision fires. Better-functioning networks are essential to advancing our ability to conduct complex military operations with greater speed and precision. However, our state of knowledge of these networks is relatively primitive and, as such, significantly impairs our ability to fully realize the potential that networks can provide on current and future battlefields. A new multidisciplinary approach is being implemented that combines communications, information, and the social/human component of networks, and that changes the way we address the challenges associated with optimizing the use of networks. Advances in network science will allow us to predict and optimize network performance before we build them through the creation of wholly new design tools.

Neuroscience—Understanding how the human brain works

Fundamental to the conduct of military operations is superior Soldier performance. Understanding how the human brain works, i.e., determining the brain's "software," is key to developing these capabilities. When embedded in a wide range of military platforms, this "software" will provide superior training methods and human system interfaces that will be tuned to an individual's characteristics, thereby resulting in superior Soldier performance. Research in this area will also dramatically advance our ability to prevent and treat those suffering from various types of battlefield brain injury.

Quantum Effects—Leap ahead in super computing

Increasing demands for information to support rapid and effective decision making on the battlefield require advanced sensor systems to collect relevant data, as well as the means for processing it into actionable forms. Major advancements in processing power are required to cope with the demand to process ever-larger amounts of data. Investments in this area will achieve super computers that will dwarf the capabilities of the most powerful computers today, making them look like pocket calculators. The development of such computational systems will enable the embedding of high-performance computing in all military platforms, including the Soldier's uniform.

SUMMARY

Army research investments are targeted in areas that are fundamental to realizing superior land warfighting capabilities and discovering new knowledge from research in areas highly relevant to the Army mission. These areas include research in network science to better understand, predict performance, and design future networks; neuroscience to better understand how the brain works so that we might improve human-machine interfaces and Soldier performance; new materials science to better protect our Soldiers and equipment; immersive virtual systems to improve our training capability; and biotechnology and nanotechnology autonomous systems. In addition, continued research is conducted in human dimension efforts relating to health and wellness, leader training, cultural awareness, and individual and unit readiness.

Army S&T has made significant progress establishing persistent night surveillance of large areas for real-time situational awareness and forensic backtracking of suspect vehicles and personnel. We've advanced the computational understanding of the battlefield through the development of practical, intelligent, and operationally relevant software tools aiding analysis and interpretation of battlefield intelligence. We are key participants in an advanced Automotive Battery Initiative with over \$2 billion committed to dual-use battery manufacturing through the Department of Energy. We have developed and deployed several lightweight power sources to reduce the demand for delivering fuel or batteries, such as the Rucksack Enhanced Portable Power System, a lightweight, portable power system capable of recharging

batteries and/or acting as a continuous power source. Through the Fuel Efficiency Demonstrator, we demonstrated multiple energy-reduction technologies and techniques to achieve a 70-percent overall improvement in fuel economy over the High Mobility Multipurpose Wheeled Vehicle through power train efficiencies, lightweight materials, reducing friction losses, and encouraging efficient driver behavior. In the past year, we conducted 12 independent readiness reviews to assess technology maturity of systems transitioning through acquisition milestones. The Army Science Board (ASB) completed two studies on increasing tactical mission effectiveness. In "Strengthening Sustainability and Resiliency of a Future Force," the ASB concluded that changes in shelters, barriers, power, and aerial resupply could provide increased survivability at combat outposts and patrol bases, reduce fuel demand, reduce the number of ground convoys, and result in fewer casualties and greater mission effectiveness. In "Tactical Non-Cooperative Biometric Systems," the ASB recommended that non-cooperative biometrics be integrated into the current cooperative biometrics base programs and be further integrated into intelligence, surveillance, and reconnaissance systems for improved mission effectiveness.

In the coming years, the Army's S&T community will continue pursuing basic and applied research and technology development in the five S&T portfolio areas: Soldier; ground; air; command, control, and communications; and basic research.

