

Army xTechSearch Focus Areas and Technology Types

Background

xTechSearch seeks novel, disruptive concepts and dual-use technologies that address Army capability gaps or technology shortfalls, manufacturing or manufacturability challenges at Army depots and arsenals, and sustainment or obsolescence issues in support of the Organic and Inorganic Defense Industrial Base. Technology focus areas may include, but are not limited to the top Army Modernization Priorities and other critical technology types with Army needs as defined below:

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Army Modernization Priorities

Long Range Precision Fires

Provide massed, mobile, operational-level kinetic and non-kinetic strike options to restore overmatch, improve deterrence, and disrupt Anti-Access/Area-Denial (A2/AD) on a complex, contested, and expanded battlefield. Potential technology areas include:

- Propulsion technologies
- Enhanced guidance/navigation
- Advanced energetics
- Next-generation RADARs

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Next Generation Combat Vehicle (NGCV)

Develop technologies that realize weight, sustainment, and cost-per-unit savings. Improve the ability to survive and win in the complex and densely urbanized terrain of a distributed battlefield where all domains are continually contested. Potential technology areas include:

- Vehicle protection
- Robotics and autonomy
- Advanced power generation and storage
- Advanced off-road mobility
- Advanced materials
- Autonomy constructs
- Artificial Intelligence/Machine Learning for Autonomy

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Future Vertical Lift (FVL)

Aviation platforms and technologies to enable unmanned and autonomous operation, reconnaissance, utility, and operation in dense urban terrain. Potential technology areas include:

- Next-generation unmanned aircraft system technologies
- Novel materials for aviation protection
- Improved situational awareness
- Advanced power systems
- Autonomy constructs
- Artificial Intelligence, Machine Learning, and Autonomy

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Network with hardware, software, and infrastructure

Provide reliable network communications in a congested environment that is secure

against attack from peer adversaries. Using a unified network architecture, provide communications for command, control, and intelligence assets using a common operating environment for seamless plug-and-play operability. Potential technology areas include:

- Secure Tactical Communications
- Interoperable hardware, software, and information systems
- Cyber offensive and defensive technologies
- Artificial intelligence and machine learning for autonomous network functions
- Networking applications capable of distributed command/control and rapid decision making
- Electromagnetic wave threat identification, location, and spoofing
- Assured Position, Navigation, and Timing (PNT) in a signal denied environment
- Cyber in support of persistent Intelligence, Surveillance, and Reconnaissance (ISR) missions
- Mesh networking techniques using commercial and military satellite constellations

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Air and Missile Defense

Reduce the cost curve of missile defense, restore overmatch, survive volley-fire attacks, and operate within contested domains. Potential technology areas include:

- High Energy Lasers
- Counter-tactical and small unmanned air systems (UAS) capabilities
- Advanced seekers
- Advanced energetics and propulsion
- Next-generation RADARs

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Soldier Lethality

Improve Soldier and small unit performance, reduce surprise, increase protection, enhance lethality, and improved training regiments for complex, urban terrain. Potential technology areas include:

- Small arms weapons, ammo and fire control
- Augmented Reality / Virtual Reality (AR/VR) for Synthetic Training Environments
- Improved Soldier protection equipment (e.g. body armor, head borne protection)
- Improved situational awareness and communications
- Digital Soldier technologies (e.g. AR/VR displays)
- Optimized and enhanced human performance

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Other Critical Army Technology Types

Medical technologies

Optimized for use in austere environments that prevent, diagnose, treat, mitigate, or

cure servicemember health threats such as injury, polytrauma, cognitive and psychological stress, and infectious diseases. Potential medical technology areas include:

- Prevention of musculoskeletal injuries
- Immediate cardiopulmonary stabilization and advanced, autonomous life support
- Medical robotics and semi-/autonomous care systems
- Diagnosis and treatment of mild traumatic brain injury
- Enhancement of human physical, psychological, and cognitive performance and resilience
- Prompt treatment of post-traumatic stress mitigating progression to PTSD
- Prevention and treatment of infectious diseases

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Military Engineering Technologies

Including 3D mapping and characteristics, cold regions science and engineering, and civil or military engineering applications. Potential technology areas include:

- Geospatial intelligence analytics
- Map-based mission planning
- Underground sensing
- Geo-Environmental Physics Modeling and Simulation

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Manufacturing and Manufacturability Technologies

Support the Defense Industrial Base. Potential technology areas include:

- Additive / Advanced Manufacturing
- Logistics
- Obsolescence

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Artificial Intelligence and Machine Learning (AI/ML)

The Army is interested in AI/ML research in areas which can reduce the cognitive burden on humans and improve overall performance through human-machine teaming. AI/ML research is needed in areas such as:

- Autonomous, intelligent maneuver and behaviors of autonomous ground and air vehicles - object recognition, threat warning, etc.
- Ability to analyze large, diverse data sets to predict enemy intent and behaviors
- Technologies to ensure robust, resilient and intelligent networking, cyber, electronic warfare and analysis of adversary signals
- Data analysis capabilities to engage with and exploit classified and unclassified sources in order to produce enhanced intelligence products
- Techniques to fuse data from disparate sources to improve a particular mission

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Assured Position, Navigation, and Timing (PNT)

The Army is interested in research involving novel new PNT technologies which could be key enablers for many capabilities including autonomous vehicles, communications, and land navigation. Solutions that enable robust PNT for vehicles, Soldiers, munitions might include research in the following areas:

- PNT technologies which operate reliably in GPS-degraded or denied areas which cannot be exploited by adversaries
- Enhancements to commercial technologies to enable them to meet Army needs
- Robust security techniques for PNT at all levels
- PNT-enabled guidance and control
- Algorithms and techniques to fuse data from multiple PNT sources to provide robust capabilities

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Autonomous platforms

The Army is particularly interested in research in autonomous ground and air vehicles, which must operate in open, urban and cluttered environments. Robotics and autonomous systems regardless of their missions require similar concepts and technologies including:

- Ability to move in very cluttered, irregular, urban and underground terrains
- Ability to move effectively in contested environments and survive attacks
- Technologies to enable low electronic and physical profiles
- Techniques to allow operators to be trained quickly even for complex tasks
- Architectures to enable reprogrammable platforms under dynamic conditions
- Sensors to detect obscured targets and to characterize terrain obstacles
- Autonomous ground and air structures, propulsion, and mobility components
- Technologies to significantly reduce logistical burdens

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Communications & networks

It is critical the Army maintain secure, reliable communications for Soldiers, vehicles and at fixed locations even in austere environments. Research is needed in the areas related to following:

- Concepts and methodologies to enable robust, secure networks
- Protocols
- Network interoperability including multi-national partners
- High efficiency components

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Computation

The Army has a growing need for high performance computational capabilities to exploit large data sets and to compute complex AI/ML algorithms for many applications.

Research is needed to improve computational capabilities in the following areas:

- Throughput
- Power efficiency
- Edge computing

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Data visualization and synthetic environments

The Army is interested in research involving concepts that enable improved situational awareness and the visualization and navigation of large data sets and to enhance operational activities and training and readiness. Research is needed in the visualization of data in following areas:

- Sensor data
- Large data sets
- Complex multi-source mode data sets
- Novel visualization and synthetic environment approaches to enable improved training
- Synthetic environments and networked instrumentation approaches for virtual-live validation of concepts and prototypes

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Human Performance

The Soldier is the foundation of all Army capabilities. Technologies that reduce Soldiers' mental or physical burden and allow them to react faster than their adversaries is needed in the following areas:

- Human-machine interaction to insure autonomous platforms are efficiently managed and exploited
- Measuring effectiveness of and enhancing training tools and techniques
- Methodologies and approaches for effective augmentation of Soldiers in areas of cognition, perception, and physical performance

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Internet of Things (IoT)

The Army needs to better integrate a wide range of capabilities and equipment and capitalize on commercial developments in the industrial and human IOT. The Army's interested is driven in part by the fact that the amount of usable communication bandwidth on the battlefield will be dynamic, and as such automated reallocation of communication resources and information sharing strategies are more challenging than commercial ones. Research is needed to improve Army IOT in the following areas:

- New concepts, quantitative models and technical approaches enabling automated management of IoT
- New machine learning techniques that accelerate decision making to address the scale/volume of IoT information and advance the science
- New approaches, low-complexity algorithms, and methods to enable secure, resilient, and to automatically managed IOT networks in highly complex, mixed cooperative/adversarial, information-centric environment
- Novel IoT approaches to enable improved training and system evaluation

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Power generation and management technologies

The Army frequently must operate where power infrastructure is not available, on small

vehicles or for individual Soldiers. Solutions that enable reliable power for vehicles, Soldiers, and munitions might include research on:

- Novel new power sources
- Power management algorithms to optimize generation and usage
- Advanced low-power electronic technologies to reduce power demand
- Compact power sources for small UAVs, robots, smart munitions

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Protection

The Army faces a number of current and future threats which it must address to protect its Soldiers. Research is needed to enhance Army capabilities for survival in the following areas:

- Sensors to detect chemical, biological, radiological, nuclear, and explosive threats
- Lightweight, easy to manufacture armor
- Cyber protection technologies, methodologies, and concepts to protect Army systems including Soldiers, platforms, networks, and munitions
- Human performance optimization to endure harsh and extenuating conditions

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Quantum Technologies

The Army seeks to better employ quantum sciences in a number of areas to improve the performance and security of its future systems. Research is needed in the following areas:

- Quantum computing to solve highly complex problems in real time
- Quantum sensing to achieve highly sensitive characterization of activities and environments and enable highly accurate navigation
- Quantum communications, and networking to enable highly secure and efficient information flow

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Sensing

The Army is interested in developing a detailed understanding of the environments and activities in the areas where it operates. Research is needed in the areas of sensors and associated processing in order to:

- Detect people, equipment, weapons, and any other object or action of interest
- Detect all targets even when obscured
- Detect based upon, physical, behavioral, cyber or other signatures

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Signature reduction

The Army needs to protect its Soldiers by making them harder to detect and locate. Research is needed to manage and reduce Army capability signatures in the following areas:

- Technologies, methodologies and concepts to reduce the external signatures of Soldiers and of all Army platforms and equipment
- Capabilities to reduce RF, optical, thermal, acoustic, magnetic and any other

signatures
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