Demand Reduction: Setting Conditions to Enable Multi-Domain Battle
White Paper

21 February 2018

DISTRIBUTION RESTRICTION: Approved for public release.

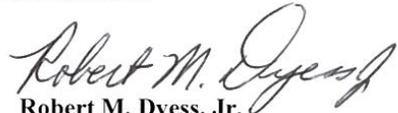This page is blank intentionally.

FOREWORD

From the Acting Director, Army Capabilities Integration Center (ARCIC)

The Multi-Domain Battle (MDB) concept describes the future vision of the Army and how we want to fight in a complex environment against near-peer competitors that will challenge American supremacy across all domains (land, air, maritime, space, and cyberspace). A key element of the MDB concept is that of resilient formations featuring units capable of operating semi-independently for up to a week without continuous resupply.

The Army demand reduction white paper is intended to promote thought and discussion concerning methods and capabilities required to sustain the Multi-Domain Battle force. We can posture ourselves for success, if we clearly understand and define requirements, identify and assess risk, and focus efforts on outputs and end states. As we move forward, it will be even more critical to precisely meet the needs of the warfighter at the right locations and at the right time.

Demand reduction must be a guiding principle that is employed across the force. The military must look to (or lead) industry in developing new and innovative science and technology to reduce consumption. Pursuing demand reduction will enable Army Soldiers and teams to defeat capable enemies and maintain overmatch by improving effectiveness and efficiency, meeting demand at the point of need, employing robotics and autonomous systems and improving situational understanding.

Success depends on Army leaders sharing a common vision and collaborating to determine how best to integrate Demand Reduction into our way of thinking, operating, and developing capabilities. Demand Reduction initiatives will improve the combat effectiveness of the force by improving operational flexibility in a contested environment.

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Purpose and Scope

United States (U.S.) Army Training and Doctrine Command (TRADOC) Multi-Domain Battle Concept: Evolution of Combined Arms for the 21st Century, describes how Army forces conduct combat operations against threats in the 2025-2040 timeframe. It offers a hypothesis to inform further concept development, war-gaming, experimentation, capability development and culture change. This hypothesis states that functional capabilities are required to enable execution of semi-independent and dispersed operations. Key among these is the objective to enable Army units to conduct semi-independent operations for up to seven days.

To meet this objective, the Army must simultaneously reduce demand and improve its ability to support Brigade Combat Team(s) (BCT) on the modern battlefield. Movement and maneuver cannot be sustained in a contested environment if tethered to traditional supply lines and the large quantities of supplies that have been a signature of the U.S. military since the American Civil War.

U.S. Army Image

The Army has established that water, fuel, and ammunition constitute the highest demand signatures, so focusing on those demands will provide the largest impact toward reaching our stated goal of operating for up to seven days without resupply. Using scenario based analysis conducted by the Operational Energy Analysis Task Force (OEATF), the Army requires at least a 30% improvement to increase the length of time units can operate without resupply.[1] This improvement can be achieved through a combination of materiel and non-materiel solutions that potentially will increase combat effectiveness. Leaders must be trained to execute logistics discipline to ensure success in an austere, intermittent multi- domain battlefield where windows of opportunity or constraint are decisive. New materiel should achieve its primary mission with demand reduction built into the system requirements. The demand reduction white paper encourages innovation via new or significantly improved products, processes, organizational methods, and internal practices such as logistics discipline.

Background

Demand is a unit's operational requirement for services or commodities that enable freedom of action, extend operational reach, or prolong endurance, but which the unit cannot independently produce or acquire. Demand stems from the commander's intent.[2] Its rate is variable, representing a sum of steady state, cyclical and surge demands.

Demand drivers vary by warfighting function or combat system and phase of the operation, with the most challenging being Phase II Seize the Initiative and Phase III Dominate. For

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[1] The Operational Energy Analysis Task Force (OEATF) is comprised of analysts from the Army Materiel Systems Analysis Activity, the TRADOC Analysis Center, the Army Logistics Innovation Agency, the Center for Army Analysis and the Deputy Assistant Secretary of the Army for Cost and Economics. This study looked at an Armored Brigade Combat Team conducting combat operations against a near peer adversary in a contested environment.

[2] From ADRP 6-0: Commanders articulate the overall reason for the operation so forces understand why it is being conducted. A well-crafted commander's intent conveys a clear image of the operation's purpose, key tasks, and the desired outcome. It expresses the broader purpose of the operation—beyond that of the mission statement.

example, in the operational environment (OE), ground combat systems are the primary demand drivers for fuel. Also human consumption, hygiene, medical and Chemical, Biological, Radiological, Nuclear and high-yield Explosives (CBRNE) decontamination requirements drive the demand for bulk water. The ammunition demand is driven by the commander's scheme of maneuver within the assigned mission against enemy formation and their capabilities.

The Army Functional Concept for Movement and Maneuver provides a key rationale for demand reduction. This concept envisions that "Operating semi-independently allows BCTs to infiltrate along multiple axes, evade enemy attacks, achieve surprise, and gain positions of advantage to isolate, envelop, or destroy enemy force. Improved mobility and sustainment capabilities, along with fundamental demand reduction, enable BCTs to operate at a tempo the enemy cannot respond to or sustain, while allowing BCTs to concentrate combat power rapidly to close with and destroy enemy forces from multiple positions of advantage."[3]

The Emerging Operational Environment

The Army will be challenged in the future operational environment across all domains as the result of a proliferation of technology and advancements by adversaries. During the past twenty years, potential adversaries have studied our operations and rapidly moved to develop capabilities exploiting observed vulnerabilities. They are rapidly developing new capabilities that will increasingly challenge U.S. Forces across the land, air, maritime, space, and cyberspace domains.

In the future OE, armed conflict will continue as a course of action for both state and non-state actors. Conditions of this environment will include unprecedented amounts of information transmitted over networks, potential emergence of innovative technologies, proliferation of weapons of mass destruction (WMD) and selected conventionally advanced weapons systems, and the novel use of highly proliferated ones. Enabled by networked advances in technology, adversaries will have the capability to apply military force with greater precision, lethality, agility, and survivability. Threat forces in this environment will retain hybrid capabilities and the ability to transition between traditional and adaptive constructs to counter conventional threats, add complexity to a given environment, and seek sanctuary in complex terrain. Conditions across the strategic environment indicate future conflict will not be confined to one simple category. It will range in scope from major conventional fights to humanitarian support and nation building missions. Peer and near-peer adversaries will continue to challenge U.S. interests globally, while rising military powers will work to advance their regional and global interests. The U.S. could potentially face a variety of missions and adversaries operating in a wide range of operational environments.

With a CONUS-based force, the challenges will begin with deployment from home station as adversaries attempt to delay, disrupt, or prevent deployment by cyber-attacks against Army and civilian infrastructure, such as road, rail, power generation, communications, and port facilities. Challenges in the cyberspace domain will continue through the entire operation as adversaries and their sympathizers seek to disrupt supply lines and critical command and control nodes.

New challenges will emerge in the maritime domain due to the proliferation of cruise missile technology, air-independent propulsion submarines, and robotic/autonomous surface and

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[3] *The U.S. Army Functional Concept for Movement and Maneuver 2020-2040*, February 2017, p.24.

subsurface combatant vessels. These capabilities will both challenge the ability of Army forces to deploy and increase the complexity of resupplying deployed forces.

Implications of the Operational Environment

A critical concern for future U.S. operations is the loss of presumptive air superiority resulting from adversary advances in technology. The emerging operational environment is significantly different from the recent past as adversaries challenge U.S. air supremacy.[4] Logistical and reconnaissance air platforms could be inhibited, thereby reducing the reach and freedom of maneuver. For example, the use of the latest generation air defense weapons may challenge our ability to conduct forward resupply by manned fixed and rotary wing aircraft.

The Army has also enjoyed superiority in the space domain, allowing it to shape the operational environment. The future operational environment includes threats to U.S. space-based assets through both physical and cyber-electromagnetic means. Threats to satellite communications (SATCOM) and space-based positioning, navigation, and timing (PNT), information collection, missile warning and environmental monitoring will impede Army forces from conducting the necessary multi-domain dispersed operations that demand reduction and other factors enable.

The future environment will be complex and diffuse, requiring Army forces to counter anti-access and area denial (A2/AD) challenges, conduct operations in complex terrain, plan and execute operations on a global scale, and sustain the force for extended periods of time in austere environments. Future commanders will need to contend with increased stress on the force, operations with joint and multinational partners, a mix of current and future organizations, systems with varying degrees of interoperability, and making sense of vast amounts of information. Regardless of the threat to U.S. national security, from the return of inter-state competition to the continuation of instability generated by non-state actors, assured access remains a significant strategic and operational hurdle. Mobility requirements will far exceed anything we know today. Warfare is projected to be more expansive in scope and scale. The battlefield will be made even more complex because of the potential for conflict in densely urbanized areas.

> "We will not have the luxury of having this massive amount of logistics behind us in future higher end, higher intensity conflict."
>
> General Mark A. Milley, Chief of Staff of the Army

Military Problem

In order to improve combat effectiveness, extend operational reach and reduce risk, the Army must reduce demand for sustaining the force while maintaining overmatch to conduct Unified Land Operations now and MDB in the future.

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[4] *Multi-Domain Strategy,* January 18, 2017

Solution Synopsis

The future environment will place significant demands on all warfighting functions, with dramatic improvements needed across the force. Owing to an emphasis on semi-independent operations and mobile protected precision firepower as emphasized in the MDB construct, lighter weight and lower volume platforms will be needed to reduce overall vehicle weight, increase system mobility and reduce demand from ground vehicles. Self-sufficient units in "fight-off-the-ramp" configurations will deploy through austere air and sea ports and transition quickly to operations. Theater support units must be tailored to facilitate this rapid employment. Forces need to leverage host nation, civil affairs units, and command post computing environment (CP CE) to obtain in-theater resources and use them appropriately and advantageously. New materials with improved strength-to-weight ratios will improve lethality and protection at significantly lighter weights. New technologies integration, distribution, and management approaches will lower fuel consumption, decrease waste generation, improve power and energy generation, and shorten the mean time to repair combat platforms.

The Army's desired outcome of demand reduction is three-fold: Increasing Operational Reach: Commanders can extend operational reach through significantly improved efficiency, lethality and endurance; Reducing Mission Risk: Decreasing demand and employing autonomous systems reduces vulnerability to enemy threats; and Improving Readiness: Readiness derived from less dependence on logistics overhead and improved tactical capability gives Commanders an operational advantage to exploit windows of opportunity.

Components of the Solution

The Army acquisition process requires many time-consuming tasks and processes. By working together, the leading Army organizations (Headquarters, Department of the Army; Army Materiel Command; Training and Doctrine Command; and Forces Command) can expedite how quickly the Army achieves demand reduction goals.

The Army must outline realistic objectives in the near-term (2018 - 2025), feasible objectives in the mid-term (2026 - 2035), and visionary objectives for the far-term (2036 - 2050). Some near-term objectives are partially funded in current budgets. Mid-term priorities have research and procurement funding lines submitted for the budget consideration. Visionary objectives have limited research and development funding programmed in the budget.

> **Components of the Solution**
> - Improve Efficiency and Effectiveness
> - Meet Demand at the Point of Need
> - Employ Robotics and Autonomous Systems
> - Improved Situational Awareness
> - Cultural Change

While reducing demand through a time phased progression, the Army must build the flexibility to adapt materiel at the rate of innovation. The Army needs integrated Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, Facilities and Policy (DOTMLPF-P) solution approaches – not just materiel solutions derived through advanced technologies.

Demand Reduction has five underlying components: Improve Efficiency and Effectiveness, Meet Demand at the Point of Need, Employ Robotics and Autonomous Systems, Improve Situational Awareness, and make Cultural Change.

Improve Effectiveness and Efficiency

Investment in improved reliability and maintainability is an integral part of recapitalization efforts. Additionally, new ammunition management and distribution approaches, using intelligent systems which better anticipate needs can be implemented. Efforts should focus on reducing energy requirements; increasing power sourcing efficiency, and improving resource management, water sourcing, recycling and repurposing, ammunition management and the development of multi-purpose armaments. Improved power plant performance/efficiency is feasible for certain fielded ground and air platforms. Auxiliary power units (APU) for ground systems are also viable.

Realistic wargames, education, and training will deliver the initial improvements. The ongoing integration of existing and emerging technologies will provide additional benefits. Finally, enabling small units to innovate in the face of adversity will provide the final benefit. The Army must explore development of critical enabling technologies. Examples of contributing efforts include: energy efficient platforms and systems that leverage current and emerging technologies; reducing the size and weight of packaging and crating to improve cargo transportation (for example, biodegradable packaging that can be left on the battlefield); using new materials to reduce chassis weights while maintaining required protection levels; more efficient power generation and distribution; Soldiers using demand informed operations; and improving the accuracy and lethality of munitions. Taking advantage of these demand reduction enablers will allow the Army to reallocate resources, including organizational changes to increase operational range, readiness, and lethality. Improved effectiveness and efficiency also aids freedom of movement by loosening the logistics tether.

Meet Demand at the Point of Need

Improvements to planning, training, tactics, and equipment will provide the required improvements at the point of demand thereby reducing the sustainment burden and increasing operational reach. Finding alternatives to bulk and bottled water will better meet point of need demands. For example, treating water on site—whether from groundwater, surface water, or recycling used water—would reduce demand for water resupply. Battlefield manufacturing systems with integrated 3-D printing can begin to provide critical repair parts with reduced resupply transportation.

Medical systems will focus on developing smaller, lighter, energy-efficient medical equipment; maximizing technology to augment medical care; increasing the shelf life and decreasing special handling requirements for medical supplies and blood products. Tactical Combat Casualty Care training and suite of enablers, Expeditionary Combat Medic, critical care flight paramedic, Forward Resuscitative Surgical Team and expeditionary hospitalization capabilities will mitigate risk by increasing the reach of advanced medical capabilities as far forward as possible. Shallow draft transport vessels, amphibious transport capabilities, short take-off and landing aircraft, and future vertical lift capable of inter-theater transit may allow entry into austere locations and expeditionary locations providing the commander more options.

These options allow US forces to operate at a tempo which hinders adversaries and complicates their decision process. Additive manufacturing capabilities will allow units to produce or adapt repair parts and end items in forward areas. At the Army institutional level, enhanced data acquisition strategies supporting additive manufacturing also support demand reduction enablers such as iterative design improvements and improved training and education

modules. Production of selected commodities and services including power and water at the point of need will increase unit self-sufficiency and reduce logistics resupply requirements. Simplified maintenance (such as expanded incorporation of line replaceable items, standardization and cross-platform parts commonality) allows repairs at forward locations by operators, reducing the need to move equipment to higher echelons for repairs.

Employ Robotics and Autonomous Systems

Just as robotic and autonomous systems (RAS) are transforming the private sector, these capabilities will transform many aspects of military operations. Efforts to enhance Soldier performance by automating tasks and providing capabilities will increase Soldier performance, minimize human performance constraints, extend operating distances and endurance, and ensure momentum. Using unmanned aerial resupply systems augments the capacity of limited manned systems, allowing faster

U.S. Army Image

supply operations over dispersed areas and increasing combat capability of engaged units. Making autonomous systems capable of carrying a sensor suite will make every platform a sensor, and capable of rapid response to reconnaissance needs in the dispersed, dynamic environment. Robotics and autonomous systems will help to increase ground forces' situational understanding by allowing persistent surveillance and reconnaissance over wide areas, while requiring less energy to conduct these missions.

Autonomous delivery platforms can increase asset utilization, and reduce Soldier exposure to hostile actions. This capability will allow the Army to evolve from traditional convoy operations to more dynamic options for resupply. More dispersed and dynamic resupply and other logistic operations will lessen adversarial capabilities to target friendly supply lines and lines of communication. On the other hand, RAS platforms introduce new vulnerabilities which must be managed to maintain overmatch. Such vulnerabilities include cyber-attack and identification on the battlefield as an unmanned asset. Employing autonomous Defensive Cyber Operations responses will help mitigate these vulnerabilities.

Improve Situational Understanding

Future Army mission command systems will provide real-time visibility of materiel availability, commodity levels, and resupply locations across the battlefield, and will enable anticipatory analytics and allow commanders to take prudent risks with better certainty. Artificial intelligence (AI), in the form of data analytics similar to IBM's Watson (an AI system with sophisticated analytical software), will reduce the cognitive load on Soldiers through the collection, organization, and prioritization of data, while autonomous platforms reduce the physical load by transporting equipment in the near term.

Incorporating artificial intelligence, improves the precision of sustainment using predictive analytics.[5] This in addition to enhanced reliability may enable forward support forces to store fewer commodities for just-in-case scenarios. Supported by Condition Based Maintenance Plus, the converged network will reduce demand and Soldier workload. Future materiel systems monitor conditions autonomously, predict and diagnose faults, and integrate with the sustainment common operating picture to optimize equipment readiness for deployed equipment.

The accelerated integration of Department of the Army and Department of Defense Enterprise Resource Planning, including the DLA Enterprise Business System, will reduce the resources required to manage multiple stove-pipe functional databases and improve visibility for more effective and efficient supply chain decisions leading to reduced distribution and inventory management related costs. The overall effect is increased equipment readiness, a reduced in-theater maintenance and logistics footprint, lower rates of equipment failure, and increased operational effectiveness.

Culture Change

Leader/Soldier education and adjustments to tactics, techniques and procedures are required to reduce demand. The Army must provide leader development and professional military and civilian education to serve as a catalyst for culture change and support developing relevant and appropriate solution approaches to demand reduction. Because of culture change and leader education, future Army forces will be adaptive and innovative, capable of conducting operations in complex environments with constrained resources applied to priority tasks. Leaders exercise mission command to prioritize requirements against potentially constrained capabilities and empower leaders at lower echelons to take disciplined initiative.

Conclusion

Without a shift in current solutions (near- to mid-term) towards demand reduction, the future force cannot be successful in conducting semi-independent operations. Soldiers and teams will be more vulnerable across the expanded operational environment, not just limited to the "forward edge." The Army must integrate efforts across the DOTMLPF-P domains to achieve objectives of improved effectiveness and efficiency, meet demand at the point of need, automate tasks, and

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improve situational understanding. The desired end-state envisions operating forces conducting MDB semi-independently in contested environments over extended ranges. Demand reduction will facilitate operations at a tempo the enemy cannot respond to or sustain, while rapidly concentrating combat power to close with and destroy enemy forces.

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[5] Adapted from: "Sustainment Innovation for Multi-Domain Battle", MG Paul C. Hurley, LTC Tracie M. Henry-Neill and Rebecca S. Brashears, *Army Sustainment Bulletin*, January-February 2018.

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Appendix A. Impact on Army Warfighting Challenges (AWFCs)

A-1. Introduction. Given the current level of development and future technology, demand reduction capabilities assist leaders and Soldiers to address many of the Army Warfighting Challenges (AWFCs) describing enduring operational problems listed in the Army Operating Concept. The AWFCs represent first-order questions to frame learning and collaboration, thereby improving combat effectiveness of the current and future force. AWFCs focus on concepts and capabilities development, and because they are enduring, allow the Army to integrate near, mid, and long-term efforts to deliver the future force. With Demand Reduction built into requirements and capability development processes, the potential opportunities to address AWFCs with innovative solutions can enhance commanders' focus on MDB. While demand reduction is likely to have far-reaching (i.e., second- and third-order) effects, not all AWFCs are directly affected by demand reduction. The AWFCs listed below are directly impacted by demand reduction capabilities sought in the near- and mid-terms.

A-2. Develop Situational Understanding: How to develop and sustain a high degree of situational understanding while operating in complex environments against determined, adaptive enemy organizations (AWFC 1).

The ability to develop Situational Understanding (SU) is the foundational element of the Army's strategy to Win in a Complex World by providing formations the means to operate semi-independently and empowering commanders and leaders to rapidly seize, retain, and exploit the initiative to defeat enemies. Future autonomous systems and greater SU of the operational environment will enable commanders to reduce demands and operate longer without a logistics tether.

A-3. Develop Agile and Adaptive Leaders: How to develop agile, adaptive, and innovative leaders who thrive in conditions of uncertainty and chaos and are capable of visualizing, describing, directing, and leading and assessing operations in complex environments and against adaptive enemies (AWFC 10).

Better Situational Understanding of assets and/or logistic support visibility provides the means to reduce the logistic tether enabling leaders to be more agile and adaptive as they counter ever changing tactics of our adversaries.

A-4. Conduct Air-Ground Reconnaissance and Security Operations: How Army formations conduct continuous integrated reconnaissance and security operations across multiple domains (air/land/cyberspace/space/maritime) to rapidly develop the situation while in contact with the enemy and civilian populations (AWFC 11).

Demand Reduction will enable deeper and longer reconnaissance and security operations as the Air-Ground combined arms team is able to conduct long missions at greater distances.

A-5. Conduct Joint Expeditionary Maneuver and Entry Operations: The Army needs formations that can rapidly deploy into contested environments, quickly transition to operations, and be sustained to maintain high operational tempo with the overmatch necessary to destroy or defeat enemy forces. (AWFC 12).

Demand Reduction allows a greater time period between initial entry and the establishment of logistics centers. It also enables both UAS and rotary wing aviation to increase either weapons load, range or station time over target area in support of dynamic targeting and precision engagements.

A-6. Conduct Wide Area Security: How Army forces establish and maintain security across wide areas (wide area security) and across multiple domains to protect forces, populations, infrastructure, and activities necessary to shape security environments, consolidate gains, and set conditions for achieving policy goals (AWFC 13).

Demand Reduction enables security teams to operate at extended ranges which allows for longer patrols and greater stability in supported areas. Reduced reliance on frequent resupply also reduces the threat of roadside improvised explosive devices by reducing the number of support convoys travelling in the secured area.

A-7. Conduct Cross-Domain Maneuver: How Army forces, operating as part of a joint, interorganizational, and multinational force, train, organize, equip, and posture sufficiently to deter or defeat highly capable peer threats in the degraded, contested, lethal, and complex future operational environment (AWFC 15).

Achieving the objectives of Demand Reduction will allow the Army to conduct Joint and Combined Arms maneuver more effectively in the current and future operational environment. Meeting these objectives is also required to fully realize the Army Functional Concept for Movement and Maneuver (AFC – MM).

A-8. Set the Theater, Sustain Operations, and Maintain Freedom of Movement: How to set the theater, provide strategic agility to the joint force, and maintain freedom of movement and action during sustained and high tempo operations at the end of extended lines of communication in austere environments (AWFC 16).

The overall demand reduction by Army forces will reduce the logistics requirements and allow the Land Component Commander to more rapidly set the theater and sustain operations while having a dramatic increase in freedom of movement.

A-9. Employ Cross-Domain Fires: How to employ cross-domain fires to defeat the enemy and preserve freedom of action across the range of military operations (ROMO) (AWFC 17/18).

Demand Reduction will contribute significantly to employing cross-domain fires by improving the lethality, capacity, and range of fires to open windows of advantage for the commander.

A-10. Develop Capable Formations: How to design Army formations capable of rapidly deploying and conducting operations for ample duration and in sufficient scale to accomplish the mission (AWFC 20).

Demand Reduction will result in a modernized Army with the sustainability and expeditionary responsiveness to deter adversaries; and deploy along contested lines of communication in an A2/AD environment. Technology allows for smaller more lethal, survivable and mobile organizations that deploy faster, are employed quicker and consume fewer supplies.

Appendix B. Acronyms and Terms

Acronyms

A2/AD	Anti-Access/Area Denial
AFC	Army Functional Concept
AFC-MM	Army Functional Concept for Movement and Maneuver
AI	artificial intelligence
AMD	Air and Missile Defense
AMP	advanced multi-purpose
APNT	assured positioning, navigation, and timing
APU	auxiliary power unit
ARCIC	Army Capabilities Integration Center
ATEC	Army Test and Evaluation Command
AWFC	Army Warfighting Challenges
BCT	brigade combat team
CBRNE	chemical, biological, radiological, nuclear and high-yield explosives
CONUS	Continental United States
CP CE	Command Post Computing Environment
DA	Department of the Army
DoD	Department of Defense
DOT_LP_-P	Doctrine, Organization, Training, Leadership, Personnel, and Policy
DOTMLPF-P	Doctrine, Organization, Training, Materiel, Leadership, Personnel, Facilities and Policy
FVL	Future Vertical Lift
ICU	Intensive Care Unit
LRPF	Long Range Precision Fires
MDB	Multi-Domain Battle
NGCV	Next Generation Combat Vehicle
OE	Operational Environment
OEATF	Operational Energy Analysis Task Force
PNT	positioning, navigation, and timing
RAS	robotic and autonomous systems
RDECOM	Research, Development, and Engineering Command

SATCOM	satellite communications
SU	Situational Understanding
TRADOC	United States Army Training and Doctrine Command
UAS	unmanned aircraft system
UMS	unmanned system
WMD	Weapons of Mass Destruction

Terms

Analysis - The process by which collected information is evaluated and integrated with existing information to facilitate intelligence production. (ADRP 2-0)

Army Warfighting Challenge - Enduring operational problems listed in the Army Operating Concept. The AWFCs represent first-order questions to frame learning and collaboration to improve the combat effectiveness of the current and future force.

Artificial Intelligence - Capability of computer systems to perform tasks that normally require human intelligence such as perception, conversation, and decision-making. Advances in AI are making it possible to cede to machines many tasks long regarded as impossible

Automation - The level of human intervention required by a system to execute a given task(s) in a given environment. The highest level of automation (full) is having no immediate human intervention, and can be considered unmanned. The remnant of human intervention at this highest automated level is left to command/control oversight (i.e. planning/task identification).

Autonomy - Level of independence humans grant a system to execute a given task in a given environment. The condition or quality of being self-governing to achieve an assigned mission based on the system's own situational understanding (integrated sensing, perceiving, analyzing) planning and decision-making. This independence is a point on a spectrum that can be tailored to the specific mission, level of acceptable risk, and degree of human-machine teaming.

Commander's Intent - A clear and concise expression of the purpose of the operation and the desired military end state that supports mission command, provides focus to the staff, and helps subordinate and supporting commanders act to achieve the commander's desired results without further orders, even when the operation does not unfold as planned. (JP 3-0)

Intelligence - 1. The product resulting from the collection, processing, integration, evaluation, analysis, and interpretation of available information concerning foreign nations, hostile or potentially hostile forces or elements, or areas of actual or potential operations. 2. The activities that result in the product. 3. The organizations engaged in such activities. (JP 2-0) Intelligence

Interoperability - Ability of a system to work with or use the parts or equipment of another system.

Leader-Follower Function - An appliqué providing a limited robotic-like capability to transportation and distribution units. A manned Leader vehicle leads three to seven unmanned Follower vehicles.

Robotic and Autonomous Systems (RAS) - An accepted term within academia and the science and technology (S&T) community and highlights the physical (robotic) and cognitive (autonomous) aspects of these systems. For the purposes of this concept, RAS is a framework to

describe systems that have a robotic element, an autonomous element, or more commonly, both. As technology advances, there are more robotics systems with autonomous capabilities.

Sensor - A device intended to detect and provide perceivable, measurable data. For the purpose of this white paper, sensor definitions for unmanned systems are wrapped into the RAS discussion as reconnaissance remains tied to one of the primary robotic mission. Sensors are critical enablers to this capability. Sensors may refer to the robots themselves or their specific mission payloads.

Semi-independent operations
Army units operating dispersed for extended periods without continuous or contiguous support from higher echelons with the ability to concentrate combat power rapidly at decisive points, and in spaces (domains) to achieve operational objectives.

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