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Technologies to
Army

Additive manufacturing employs computer-aided design and manufacturing capabilities to create objects through layer-by-layer printing. (Photo by Amanda Dunford)

Sustain the
of 2025 and Beyond

■ By Capt. MuShawn D. Smith

New sustainment technologies will help the Army retain overmatch with a more capable, leaner expeditionary force.

Imagine the Army having unmanned air and ground distribution platforms, the capability to manufacture replacement parts on the battlefield, and the ability to produce water from air. Think of how current technologies can potentially advance tomorrow's Army capabilities in order for the Army to remain the best equipped and most efficient military force in the world.

To maintain an operational advantage over potential adversaries, the Army must prioritize science and technology investments and fully leverage game-changing capabilities. The Army of the future requires technologies that increase expeditionary capabilities, reduce sustainment requirements, and optimize Soldier performance.

Tomorrow's technologies are available today and will be instrumental as the Army transforms to be globally responsive and regionally engaged. This article describes the Combined Arms Support Command (CASCOM) Sustainment Battle Lab's top five game-changing technologies to sustain the Army of 2025.

What the Army Needs

The Army of the future requires the implementation of various technologies to facilitate Chief of Staff of the Army (CSA) Gen. Raymond T. Odierno's vision and strategic priorities.

The CSA's vision is for the Army to remain the world's most highly trained and professional land force, uniquely organized with the capability and capacity to provide expeditionary, decisive landpower to the joint force. The Army of the future must remain ready to perform missions across the full range of military operations to prevent, shape, and win and to defend the nation from both current and emerging threats.

The CSA's strategic priorities for a globally responsive and regionally engaged modern Army are driving capabilities developers to assess technologies against the following core characteristics:

- Overmatch: Have capabilities that counter those of a potential adversary.
- Leaner: Reduce force structure and enable a scalable, modular force.
- Expeditionary: Be able to rapidly deploy and operate in austere theaters.

CASCOM is taking vigorous steps to explore how technologies can support expeditionary warfare. It identified reducing demand as one of the Army's toughest challenges and the key to realizing success.

Demand determines sustainment requirements, and by reducing demand, U.S. forces will be more capable of increasing expeditionary capabilities. CASCOM capability developers identified five technologies that will yield significant game-changing benefits by the year 2025.

Autonomous Ground Resupply

The near-term technology driving autonomous ground resupply is the Autonomous Mobility Appliqué System (AMAS). AMAS is an add-on kit that converts existing manned vehicles to be optionally manned. AMAS does not change the vehicle's cabin configuration, so the vehicle can be converted from being manned to unmanned at the convoy commander's discretion.

AMAS is a technology that is currently being evaluated in a joint capability technology demonstration. AMAS is a bridging technology to the initial autonomous ground resupply series of vehicles, branded as automated convoy operations (ACO) vehicles. ACO vehicles incorporate automated capabilities into existing tactical wheeled-vehicle platforms to enable the vehicles to operate with minimal human input to accomplish assigned missions.

These vehicles will use sensors and vehicle actuators to determine and navigate the most appropriate routes. With this technology, vehicles can then operate independently or in manned/unmanned teams in which several vehicles can be controlled and

An M1075 palletized load system truck and an M915 line-haul tractor are equipped with add-on kits that transform the vehicles to be fully autonomous. (Photo by Bruce Huffman)

assigned missions remotely using one operator control unit.

Autonomous ground resupply technologies have several potential benefits:

- Reduce constraints related to Soldier endurance.
- Reduce Soldiers' exposure to vehicle accidents.
- Increase logistics efficiencies and throughput capabilities.
- Reduce vehicle fuel consumption through resupply efficiencies.
- Expand options for delivery frequency.

Imagine a 12-vehicle convoy comprising three gun trucks, eight sustainment vehicles, and one recovery vehicle. This convoy currently requires at least 27 Soldiers. The implementation of AMAS will potentially reduce this requirement to as few as nine Soldiers.

Additive Manufacturing

Additive manufacturing (AM), also known as 3-D printing, employs computer-aided design and computer-aided manufacturing capabilities to create objects through deposition, or layer-by-layer printing. Although currently being used in a small commercial sector, AM is being proposed as a near-term solution throughout the Department of Defense for producing certain replacement parts at the point of need.

AM allows organizations to produce spare parts, supplies, and other required fabrications to improve logistics metrics and operational readiness to support requirements at the strategic, operational, and tactical levels. The objective of AM is to rapidly produce materiel to meet requirements at the point of need, thus reducing the flow of demand back through the entire supply chain.

AM machines that produce plastics are already available at Army depots, and the Rapid Equipping Force has already developed a mobile capability that is in use in Afghanistan. AM systems for plastics and polymers are relatively well-developed compared to metal systems and can be further employed throughout the Army sustainment system today, provided the right technical data is available for parts, user controls, and materials.

Advanced AM capabilities for metallic components are relatively new but progressing rapidly. Large AM systems (for example, the Renishaw AM250 laser melting machine) have already been proven to have the capability to produce limited metallic

A 3rd Cavalry Regiment motor transport operator configures the route for an autonomous convoy using a ruggedized tablet while a Combined Arms Support Command officer reviews the plan. (Photo by Bruce Huffman)

components. Michigan Technological University has even developed a desktop 3-D printer and welder that produces steel components. AM capability is a near-term technology that will contribute significantly to the expeditionary capabilities of the Army.

AM technology may achieve these sustainment benefits:

- ☐ Meet demands at the point of consumption.
- ☐ Improve customer wait time and other supply performance metrics.
- ☐ Reduce authorized stockage list lines.
- ☐ Ensure the operational readiness of combat systems.
- ☐ Reduce supply chain demand.
- ☐ Reduce the logistics footprint.

Suppose a critical combat system on the battlefield is deadlined because it needs a particular part. The part is back ordered, and the estimated ship date is two months away. AM will allow that supply support activity to produce the part in one day, reducing the wait time by at least 60 days and increasing operational readiness.

Automated Aerial Resupply

The delivery of cargo as far forward as possible is the ideal situation for reducing the supply chain. Cargo unmanned aerial systems can deliver cargo farther forward on the battlefield without endangering the lives of Soldiers. Autonomous aerial delivery provides point-to-point delivery routes (air corridors) that increase throughput and allow for the remote delivery of materiel in most environments.

One such platform, the Kaman K-MAX helicopter, is a near-term technology currently being employed by Marines operating in Afghanistan. K-MAX provides cargo delivery when weather, terrain, and enemy actions pose unreasonable risk to air and ground assets.

The use of this unmanned aerial resupply platform has increased throughput while reducing the operational and maintenance costs typically associated with rotary wing support. Most importantly, autonomous delivery reduces risk to Soldiers and offers a speedy distribution capability.

Several benefits can potentially be achieved through autonomous aerial resupply technologies:

- ☐ Reduce delivery times.
- ☐ Increase responsiveness through on-demand delivery.
- ☐ Remove risk to Soldiers while offering delivery to remote locations.
- ☐ Ensure operational readiness of combat systems.
- ☐ Reduce the demand for ground convoys and their security escorts.
- ☐ Support expeditionary maneuver.

Envision a combined arms battalion in need of emergency resupply during intense combat operations and inclement weather while all ground supply routes are restricted. Imagine an unmanned aerial platform bypassing these constraints and expediting the emergency resupply operation to provide critical materiel.

Water From Air System

Water produced at the point of need will reduce, if not eliminate, the requirement to transport water the length of the logistics tail. The water from air system (WFAS) extends freedom of maneuver for command-

ers by granting expeditionary support through potable water production at the forward edge of the battle area. WFAS provides warfighters the means to continuously generate potable water during all phases of operations without increasing the distribution footprint.

WFAS is a unit-level water generation system that extracts potable water from the atmospheric humidity. The system is mounted on a 7.5-ton trailer and is projected to generate 500 gallons of water per day. There are also smaller capabilities that can be mounted to existing platforms.

The average output capability of today's system is five gallons of water for every one gallon of fuel. Although there is a trade-off between water and fuel, the system still offers an 80-percent overall reduction in transportation requirements related to water support.

WFAS forward on the battlefield has the potential to significantly reduce or eliminate the distribution of bulk water within modular brigades and dramatically reduce bottled water requirements.

WFAS may yield the following benefits:

- ☐ Allow production and storage at the point of consumption.
- ☐ Reduce water distribution.
- ☐ Reduce force structure.
- ☐ Reduce the logistics tail.
- ☐ Counter potential enemy water threats.

Visualize enemy forces targeting resupply convoys with the intent of depriving friendly forces of water. WFAS counters that threat and enables forces to conduct continuous operations to generate their own water, prolong endurance, and extend operational reach.

IPMDS

The Intelligent Power Management and Distribution System (IPMDS) is a far-term technology that comprises a combination of hardware and software that optimizes the production, distribution, and use of electrical power. IPMDS incorporates automatic phase balancing, ground fault protection, and enhanced 24/7 power distribution reliability to reduce Soldier support, intervention, and training.

IPMDS reduces the requirements for energy during expeditionary operations and the amount of power generation equipment needed during initial entry. Without degrading capabilities, this system increases unit endurance and freedom of action, while reducing man hours related to maintenance and transportation. Recent studies have projected a 30- to 40-percent reduction in the amount of fuel used for power generation.

The following benefits can potentially be achieved by IPMDS:

- ☐ Counter the enemy's potential threats to U.S. Army energy.
- ☐ Reduce energy requirements.
- ☐ Reduce maintenance and transportation requirements.
- ☐ Reduce force structure.
- ☐ Reduce fuel demand.

Picture a remote brigade combat team operating autonomously and relying on host-nation support for power generation. The tactical operations center receives orders to relocate the site and reestablish operations at an area outside of the power grid.

The IPMDS can expedite the move while maintaining functionality and make the reestablishment of operations more seamless. IPMDS eliminates host-nation power generation support requirements, allowing for a leaner, more self-sufficient, and more expeditionary force.

CASCOM conducts globally responsive sustainment rehearsal of concept drills to validate sustainment roles and responsibilities and recommend restructuring options. One of the drills' major objectives is to use each emerging technology in a simulated operational environment to determine which emerging technologies will enable expeditionary sustainment support of strategic landpower.

CASCOM has coordinated with a host of organizations and science and technology stakeholders to establish a forum for greater integration, synchronization, and collaboration. As the Army moves forward to a more capable, leaner expeditionary force, more experiments, evaluations, exercises, wargaming, and other efforts focused on determining the force design of 2025 are necessary.

Soldiers at all levels must share in the effort of making the Army of 2025 the most highly trained and professional land force in the world. This will take the support and continuous effort of the entire Army team over the next 10 years.

Moving forward, capability developers will continue to leverage science and technology to meet the CSA's intent. Capability developers will conduct activities along three primary lines of effort: force employment, science and technology and human performance optimization, and force design.

The science and technology line of effort will continue to focus on identifying game-changing technologies to optimize the force. Science and technology communities will remain deliberate and continue to coordinate and provide senior leaders with capabilities that retain overmatch, increase capability, and foster a leaner expeditionary force.

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