

THE PATH TO 2024

DISTRIBUTION WHITE PAPER



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THE PATH TO 2028

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UNITED STATES ARMY COMBINED ARMS SUPPORT COMMAND
SUSTAINMENT CENTER OF EXCELLENCE
2221 ADAMS AVENUE
FORT LEE, VIRGINIA 23801-2102

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FOREWORD

The Army finds itself at a pivotal point for decision making about how to best move into the future. Given an exponential increase in the pace of change and advancement of technology, bold logisticians will produce the game changers necessary to ensure the Army of 2028 possesses an unmatched, versatile mix of capabilities to sustain any operation. The challenge is to decide what we want our future to look like and how to make it happen.

Within the Army's conceptual framework of 2016 to 2028, we use notional vignettes to highlight potential changes and capabilities, and to stimulate your imagination and thought development. You can further investigate ideas and technology by clicking on embedded links found throughout the paper. To begin the discussion, we have outlined game changers in three key areas to organize and harness the thought, discussion and decisions as we move toward the future:

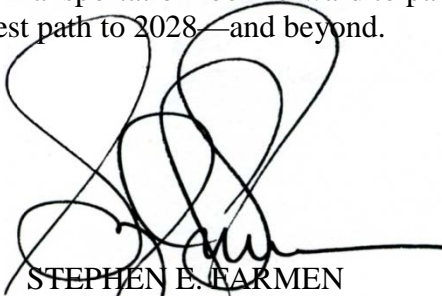
1. Culture
2. Technology
3. Organizations and People

The real key to success is to continue our conversation. We live in a participatory world and your input counts. We want to hear from you. Please go to www.discoveringdistribution.org and join the conversation.

The Commanding General, Combined Arms Support Command (CASCOM), Sustainment Center of Excellence (SCoE), and the Chief of Transportation look forward to partnering with you as, together, we determine and travel the best path to 2028—and beyond.



JAMES L. HODGE
Major General, USA
Commanding, CASCOM



STEPHEN E. FARMEN
Brigadier General, USA
Chief of Transportation

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THE PATH TO 2028

The task of the leader is to get his people from where they are to where they have not been.

Henry Kissinger

Imagine you are standing atop a mountain in 2028¹ and looking back to 2012. What you see are the major efforts in three main areas—culture, technology, and organizations and people—led by senior officers and non-commissioned officers who turned concepts into reality.

* * *

As 2012 began, large-scale military operations in Iraq were complete, and redeployment, retrograde, and reset operations were well underway. Once again the Pakistan ground line of communication was [closed to allies](#) and the Department of Defense was reacting to changes in the Operation Enduring Freedom (OEF) landscape. Senior leaders were focused not only on current operations but also on other potential anti-access and area denial strategies of our adversaries. The debt and deficit issues, recession, unemployment levels, the European debt crisis, overarching discussions on the role of government, the emergence of China as a global leader, a leadership change in North Korea, and the repercussions of the Arab Spring occupied our thoughts as we considered the national defense strategy and the way ahead. A multitude of state and non-state actors were developing strategies or executing operations to test America by

- electronically high-jacking and hacking our unmanned systems and critical networks,
- leveraging commercial off-the-shelf technology to enable [narco-terrorism](#), and
- developing traditional and new weapons of mass destruction and methods of environmental warfare.

Sixteen years ago, the Army faced steep budget and force structure cuts and questions about its relevancy. The logistics branches were continuously pressed to execute operations more efficiently and effectively. The Combined Arms Support Command (CASCOM) was examining the role of new air and ground delivery methods (including innovations for rail and watercraft) and movement control within Army Expeditionary Intermodal Operations. CASCOM was also taking a hard look at the deployment and [distribution](#) process to ensure a post-OEF/Operation Iraqi Freedom (OIF) Army had the capability and capacity to meet global requirements.

Persistent conflict, change, global interdependencies, demographic trends, and exponential technological advancements complicated the strategic environment. America's Army still required the capability to prevent and shape conflict, but also required the capability to win decisively when called upon, as outlined by General Odierno in 2011.²

¹ *The Army Capstone Concept—Operational Adaptability: Operating Under Conditions of Uncertainty and Complexity in an Era of Persistent Conflict*, 21 December 2009, and the *2010 Army Operating Concept: 2016–2028*, 19 August 2010, provide us the doctrinal framework out to 2028.

² *Prevent, Shape, Win*, General Odierno, <http://armylive.dodlive.mil/index.php/2011/12/prevent-shape-win/>, 12 December 2011.

The 2012 defense strategic guidance³ prompted critical decisions that focused our deployment and distribution capability development efforts and investments to enable a more rapidly deployable, agile, flexible, innovative, and technologically advanced Army.

The capabilities we possess in 2028 seemed unimaginable and wholly unattainable back in 2012. But as we stand today, in 2028, our platoon sergeants and platoon leaders of all specialties and branches are leading more complex, increasingly diverse organizations. They synchronize operations of manned and unmanned platforms, Soldiers, government civilians, contractors, and complex information systems. They do so with relative ease and confidence because they have been trained well and are technically proficient—not so much in how to use the systems, but in how to process voluminous amounts of data into meaningful information and synchronize operations. They are like practiced conductors leading an orchestra through a complex symphony...often while under fire!

* * *

As you read this paper, think about the challenges of 2012, and then consider the possibilities and opportunities we could expect for logistics in 2028. We use vignettes to prompt thought and introduce the “realm of the possible” for 2028.

The purpose of this paper is to **generate thought and discussion on both the concepts presented and on the concepts that are missing**. The paper is not prescribing solutions; that will follow later, after **we have a healthy discussion about where we should prioritize our energy and efforts**. Although focused mainly on overcoming the current seam where sustainment and maneuver intersect—distribution—we believe these discussions are relevant to all logisticians, and we must take these thoughts and expand on them as we plan for our future.

What Our 2028 Army Looks Like

Reduced force structure and aging equipment drove an investment in targeted technologies and new approaches, enabling an entirely different force dynamic than what the Army knew in 2012. We created a more expeditionary, state-of-the-art force by

- retraining and enabling our force to rapidly deploy with no notice and operate effectively in anti-access and area denial environments;⁴
- expanding the utility of unmanned logistics platforms;
- reducing our reliance on carbon-based fuels;
- utilizing more versatile and militarily useful commercial off-the-shelf [technology](#) and solutions;
- incorporating system-wide [intelligent agent](#)–embedded software and achieving effective information filtering and optimal decision making;

³ *Sustaining U.S. Global Leadership: Priorities for the 21st Century*, http://www.defense.gov/news/Defense_Strategic_Guidance.pdf, January 2012.

⁴ *Ibid.*, p. 4.

- processing and sharing data and actionable information and providing a relevant, enterprise-wide stakeholder common operating picture;
- revolutionizing virtual training techniques to fully enable Soldiers and Army civilians who can thrive in complex situations and leverage technological advances; and
- countering the increasing [electromagnetic pulse](#) (EMP) threat by designing EMP protection into new procurements or retrofitting existing systems.



These advances enabled worldwide logistics support, which gave our operators unmatched agility. The confidence operators have in our logistics enterprise continues to grow with each operation.

* * *

The following vignette recounts the special relationship between the Army Special Forces and the deployment and distribution stakeholder communities, which work together to develop multi-modal transformational capabilities. It highlights the use of [robots](#) throughout all phases of operations and the use of Army waterborne enablers as expeditionary command and control platforms and logistics and distribution hubs.

1 August 2028—LTC Smith, Commander, Army Special Forces, Operational Detachment–C, stands in the Intermediate Staging Base in the Pacific having just deployed from Fort Bragg with his teams. He’s there to conduct Security Force Assistance operations—well ahead of a show of American resolve through an expeditionary deployment readiness exercise of the Global Response Force.

He recalls his deployments years ago as commander of a Special Forces A-team—the first in Iraq and then in Afghanistan—and the resupply pallets guiding themselves in from the sky to the general vicinity of his point of need...at least most of the time! Now, he marvels at how remotely piloted and unmanned, [intelligent agent](#)–enabled delivery platforms operate in all domains, delivering precisely what is needed to the exact point of employment on the ground for his teams. Remotely piloted and unmanned platforms have become widespread throughout the military. Even close air support, both manned and unmanned, is now enabled by remotely piloted and unmanned aerial refuelers, which remain overhead 24/7.

He watches his teams’ pre-execution checks of personal gear and their high-speed, tactical surface/sub-surface watercraft, which will be loaded aboard the Army’s newest maneuver enhancement vessels (MEVs), and he thinks about how the point of embarkation really does equal the line of departure for his guys. He’ll monitor the insertion and operations of his teams from the feeds sent back from his teams’ micro-UASs and [modular unmanned surface craft, littoral \(MUSCL\)](#), and the reports from his B-team commander using one of the MEVs as a command and sustainment “mothership.” As he finalizes plans for employment, he has full confidence in the ability of the logistics enterprise to sense what he needs on the ground and have it delivered where and when he needs it.



Waterborne platforms enable expeditionary, intermodal operations.

The Drivers That Shaped Our 2028 Army

Back in 2012, renewed calls for another [peace dividend](#) continued to be sounded in an attempt to fund other national priorities. “Do less with less!”⁵ became a reality, and senior leaders had been forced to assess and clearly articulate risk in the face of significant defense budget cuts. As predicted, the operational and strategic environment of 2028 turned out to be no less dangerous than 2012. As outlined in the *Joint Operating Environment*,⁶ manmade and natural disasters occurring throughout the “arc of instability”⁷ require economy of force and prudent application of our forces. Strategic challenges are complicated by

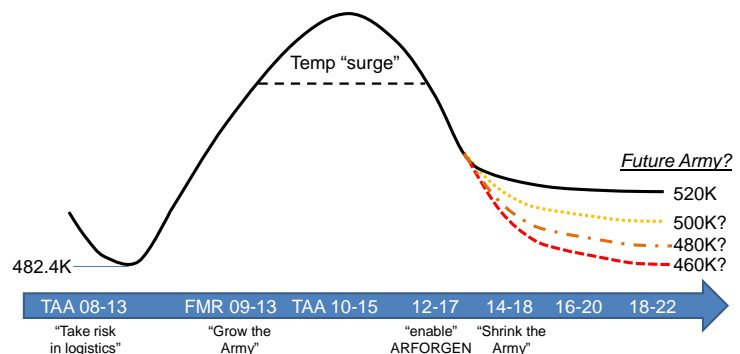
- increasing concentrations of people due to population growth and continued migration into cities,
- greater global and regional competition and demand for limited natural resources, and
- non-state actors threatening national interests at global flashpoints.



The departures from Iraq and Afghanistan precipitated the shift to a comprehensive [global insurgency](#). With ever-increasing numbers of Army forces stationed within the United States, meeting global commitments with “boots on the ground” meant overcoming the “tyranny of distance” through rapid force deployments.

The long-held strategy for fighting a two–major theater war was altered to a one–major theater war construct, but retaining the ability to “be capable of denying the objectives of—or imposing unacceptable costs on—an opportunistic aggressor in a second region.”⁸

This shift was based on the reality of what was possible given a smaller military, fewer resources, and national war fatigue. As 2012 began, prognosticators couldn’t agree on how much and how fast



No one knew how much or how fast the Army would shrink once the war in Iraq ended, but knew we needed to get more efficient and effective.

⁵ Remarks by General Odierno at AUSA Eisenhower 11 October 2011 luncheon, <http://www.army.mil/article/67090/>.

⁶ The *JOE 2010, Joint Operating Environment*, 18 February 2010, U.S. Joint Forces Command, pp. 60–62.

⁷ General Jim Amos, USMC Commandant, refers to troubled areas as falling into the “arc of instability.” *Military Times*, “Hotspots: You might deploy here next,” <http://militarytimes.com/news/2011/12/marine-hotspots-you-might-deploy-here-next-120511w/>, accessed 23 January 2012.

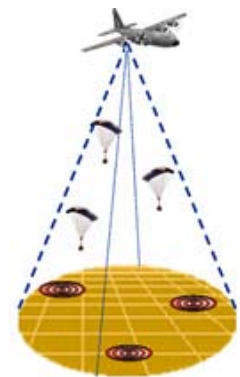
⁸ *Sustaining U.S. Global Leadership: Priorities for the 21st Century*, http://www.defense.gov/news/Defense_Strategic_Guidance.pdf, January 2012, p. 4.

the Army would shrink.⁹ Both President Obama and General Odierno were articulating the importance of avoiding cutting too much, too fast—risking a resulting “hollow” force. Army leaders managed to strike the balance.

The Joint Staff, in conjunction with the Services, fundamentally changed war planning after 2012. Fiscal austerity measures threatened to constrain capabilities and dictated new approaches. Everyone knew DoD funding levels were unsustainable, and enhancing our supply chain to maximize velocity and information in order to reduce mass and footprint was a critical necessity. Process changes and new business rules allowed for visibility of knowledge, capacity, and expertise across the joint, interagency, intergovernmental, multinational, nongovernmental, and commercial (JIIM-NC) community and enabled us to tap into all resources as they were required.

Funding for the Global Command and Control System–Joint (GCCS-J) was focused on its transformation and critical applications, like the Joint Operation Planning and Execution System (JOPES). Transformation focused on rolling together the stove-piped deployment and distribution management and control systems of each Service to create a truly Joint deployment command and control system. The Army followed the trend and merged its transportation and distribution systems with the logistics automation enterprise, the Global Combat Support System, and saw exponential efficiencies in logistics management as technology evolved. This was expanded and integration occurred across the Joint enterprise. Today’s “virtual JOPES” embeds the real-time readiness status of all military service units, creating a virtual global Time Phased Force Deployment Data List. The supported geographic combatant commander can now select from a menu the right size unit and capability to deal with an evolving situation or crisis in his or her area of responsibility. Because this capability is not limited to military options, it has enabled a truly JIIM-NC approach to planning and execution.

New joint doctrine also emerged for the employment of autonomous and semiautonomous robotic vehicles, which had a ripple effect across Joint and Service operational concepts. Unmanned air and sea lift assets have been added to the system as they are fielded, which improves versatility in the resupply of units. The Joint Precision Airdrop System has evolved, and seabasing proved viable with the successful fielding of remotely piloted cargo unmanned aerial systems (UASs) that could deliver supplies from the seabase directly to the point of employment.



Seabasing was also enabled by the accomplishments of a Joint program of-fice for waterborne enabler development. In addition, the Improved Container Delivery System has allowed heavier loads (up to 10,000 pounds) and greater precision from airdrops of altitudes between 18,000 and 20,000 feet, thereby reducing dangers for Soldiers and Airmen alike. More recent advances introduced steerable platforms that employ airbag technology from the automotive industry; the same heavy weights can be dropped successfully, with greater survivability and precision.

⁹ For a description of various “sequestration” scenarios for Army end strength, see *Army Times*, “How the pending defense cuts could play out,” <http://www.armytimes.com/news/2011/12/army-how-pending-defense-cuts-could-play-out-120311/>, Lance M. Bacon, 3 December 2011.

The unqualified upsurge in intelligent agents in [smart phone applications](#) in 2012, like real-time re-routing to avoid traffic congestion or accidents, was only a precursor to the ubiquitous application of intelligent agents as logistics enablers. The complexity of our 2028 intelligent agent-enabled systems make the 2012 applications seem prehistoric. Intelligent agent-embedded and enabled “smart” systems have fundamentally changed how the Army supports warfighters across the logistics realm in such areas as [condition-based maintenance](#), movement control integration, supply forecasting and optimization, and financial transactions and controls.

Distribution of materiel is now a given. Soldiers have complete trust and confidence that they will be resupplied before they even think about asking for resupply. The very concept of logistics support is as agile and versatile as our military’s movement and maneuver capability.

Demand signals, customer requirements, readiness status, taskable assets, threat information, delivery tracking, and anything else required to optimize the deployment and sustainment of forces have been enabled by

- enhanced and synchronized training,
- secure networks,
- complementary systems,
- intelligent agents,
- humans,
- [virtual humans](#),
- platforms,
- organizations,
- shared data and information, and
- processes and policies.

The key was getting it all working in concert to optimize and deliver combat power and logistics capability anywhere in the world on short notice.

The Game Changers

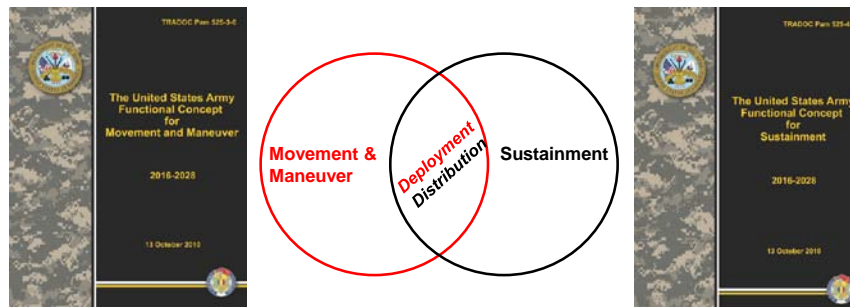
The path to 2028 wasn’t always smooth. Sometimes we proactively sought enablers; other times we acquired enablers on the fly...in a reactionary mode. But we got here, with [changes](#) and investments in three key areas:

1. Culture
2. Technology
3. Organizations and People.

Game Changer #1: Culture

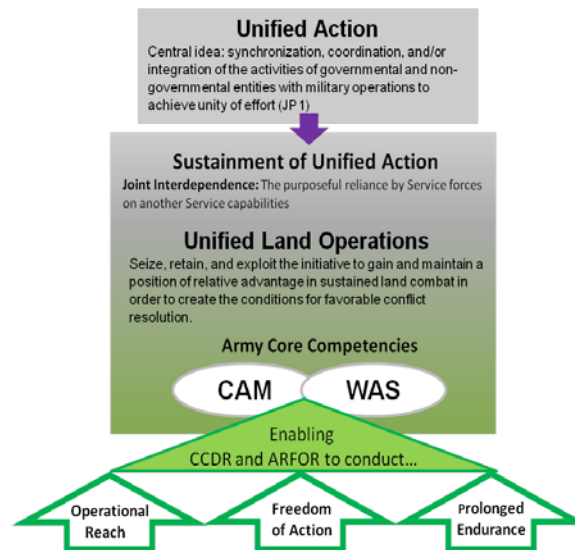
Integration of Maneuver and Sustainment

Many in the military are charged with experimenting with change. Their biggest challenge has always been the necessary shift in the cultural mindsets and breaking our propensity to revert to the comfortable and the clearly delineated. Shared space is a notoriously uncomfortable place to be for a Soldier or an Army civilian, **but it was necessary to share the space between the movement and maneuver and the sustainment warfighting functions.** It is at the convergence of these two functions where we, as multifunctional logisticians, enabled unified action¹⁰ and [unified land operations](#). It is in this shared space that we precluded operational pauses.



At the convergence of movement and maneuver and sustainment, we enabled unified action and unconstrained, dynamic maneuver.

Our cultural mindsets had to shift significantly within and among the Army logistics and operational communities, and within the Joint logistics enterprise. Expeditionary logisticians, who were trained as experts in supply chain integration, provided the connective tissue and capabilities. They successfully integrated the movement and maneuver and sustainment warfighting functions that allowed unified and decisive action to occur.



Expeditionary logisticians provided the connective tissue and capabilities to ensure the success of unified action.

¹⁰ Army Doctrine Publication 3-0, *Unified Land Operations*, October 2011, p. 3.

We also became comfortable with blurry lines and ever-shifting, loose [coalitions of the willing](#) and like-minded (both within our own organizations and those external to us).

The lines blurred between

- the strategic, operational, and tactical levels of war;
- the various JIIM-NC organizations contributing to the “distribution enterprise”;
- JIIM-NC sources of supply, maintenance, transportation, and information; and
- nation states, rogue states, failing states, and non-state actors, like terrorist organizations, jihadists, and criminal organizations.

Multiple-Player Integration

Transformational deployment and distribution capabilities, centered on a JIIM-NC approach, took the 2012 unified action framework even further. Now, in 2028, expeditionary logisticians across the JIIM-NC community sustain global movement and maneuver; we enable operational reach, freedom of action, and prolonged endurance. We provide distribution capability to sustain employed forces anywhere on the ground, in ever shifting geographic spaces that require wide area security—sometimes tightly focused, sometimes regional, and sometimes global. We operate as a critical component of the Joint Deployment and Distribution Enterprise—a confederation of JIIM-NC professionals dedicated to successful outcomes. We collaborate and freely share data, information, assets, and personnel; whatever it takes to make the employed forces (maneuver, maneuver enhancement, sustainment, and deployed elements from the other instruments of U.S. national or multinational power) successful in their missions. This integration occurred because Army logistics leaders helped champion the dialog in forums within and among JIIM-NC stakeholder communities.

The varied threats to national and global security were a catalyst that necessitated a full-court press among U.S. allies and like-minded nations to pool their resources and adopt JIIM-NC policies and initiatives to share the burden of global stability and response measures. **Information sharing—and the willingness to share—was a necessary first step to the cooperation and collaboration needed to enable JIIM-NC-based operations, which leveraged all instruments of multinational power.** Processes and interoperable systems have since been honed, and stakeholder buy-in allows for integrated JIIM-NC operations.



Synchronization with government, non-governmental, and commercial support organizations is an operational imperative.

Strategic Maneuver

Espoused as an operational imperative in the years leading up to 2012, deploying as immediately employable formations has become a reality for our global quick-response forces in 2028. We now work beyond traditional service boundaries to defeat the anti-access and area denial threats, as called for in the *Joint Operational Access Concept*.¹¹ We ensure more of our Army forces—beyond the significant expansion of our special operations, airborne, and air assault formations—achieve that contingency, expeditionary quality, and we provide the credible, immediate response options for pressing global requirements. The senior leaders of 2028 were tempered early in their careers by operations in Haiti, Iraq, and Afghanistan; weapons of mass destruction attacks against our homeland; and the multitude of global operations that have occurred since 2012. Their collective operational experience, education, and cultural mindset have made it possible to transform our institutions and the deployment and distribution enterprise to what it is today.

On the path between 2012 and 2028, we also had to consider the divide between how we conceptualized our own movement and maneuver and sustainment warfighting functions. We continually tested and improved our immediate response capability, particularly in how we train our forces, enable the rapid deployment process, and incorporate other entities into our planning process. Insertion of smart technology into our processes allowed for an en route mission planning capability, which was critical, given the changing engagement environment, missions, and partners.

We have learned that adaptation must be continuous and ever more rapid!

* * *

The next vignette highlights the dynamic, complex strategic environment of 2028, and how we evolved the synchronization of JIIM-NC deployment and distribution operations to deal with it.

As illustrated in this vignette, JIIM-NC synchronization is an operational reality. The strategic environment and resulting strategy guided the United States to package its national security efforts in the context of a JIIM-NC approach, as codified in the 2012 defense strategic guidance¹² and the 2013 *National Security Strategy*.

¹¹ *Joint Operational Access Concept*, <http://www.dodlive.mil/?s=joac>, 17 January 2012, p. 19.

¹² *Sustaining U.S. Global Leadership: Priorities for the 21st Century*, January 2012, http://www.defense.gov/news/Defense_Strategic_Guidance.pdf, p. 8.

13 September 2028—LTC Brown, Commander Task Force (TF) 11, deployed her battalion as part of FORSCOM's Global Response Force to Namibia in support of USAFRICOM operations following a devastating tsunami. An earthquake, centered on the Walvis Ridge in the South Atlantic Ocean, caused the tsunami that devastated the Namibian coastline and damaged its only two seaports in Walvis Bay and Luderitz. TF 11 will support [humanitarian assistance and disaster relief](#) operations for military support to the civilian authority. Within 96 hours of a request from Namibia to the U.S. State Department, America's Global Response Force was on the ground with an airborne infantry brigade combat team (IBCT) conducting wide area security operations. The Sustainment Brigade (Port Opening) was on the ground and had established the Harbormaster Command and Control Center to synchronize seaport operations and provide a common operating picture of all arriving multinational and commercial relief shipments; The Center would become LTC Brown's one-stop shop to gain visibility on the incoming relief supplies, which her team would later deliver.



On the flight over, LTC Brown visualizes her upcoming mission of an in-stream discharge operation, and the enablers that have been fielded during the last decade to facilitate the mission. Her battalion will employ relative motion technology—equipped lighters, ships, and platforms. They can effortlessly load, transit and offload vehicles in a virtual “swarm,” even in [Sea State 3](#).¹³ LTC Brown knows she can direct operations to multiple offload points from bare beach sites, local boat launch ramps, and unimproved ports. To ensure the most effective employment of forces she can use autonomously generated offload and execution plans based on the intelligent agent—derived optimization models for throughput. Most important, the enterprise enjoys not only real-time asset visibility but also total JIIM-NC asset visibility. This gives LTC Brown a comprehensive picture of all movements inbound to the port or airfields from all organizations participating in the response. LTC Brown and her staff held an en route mission planning and rehearsal session and acquired asset visibility and inbound cargo downloads from all of the Services, USAID, Doctors without Borders, the Home Depot, Red Cross, other non-governmental organizations, and multinational representatives.

She has already seen one request forwarded to her ordnance company from the Russians for a propeller shaft that broke on one of their lighters during loading. The Russians just emailed the page from the craft's specifications publication, and the new shaft will be “[printed](#)” on-site using direct digital manufacturing (DDM) and await the vessel's arrival. Fortunately, the Russian's electronic payment for the part will be made almost as quickly as the new prop shaft. The ordnance company will offer the same level of support to all members of the coalition—even the commercial craft and other equipment participating in the operation—because they can print any part or component needed on their 3D printer.

Still in flight, LTC Brown receives a video call and an update from her S-3, who is on the ground in Namibia. Navigating the real-time database feed from the prepo ships, she knows the shipboard Dense Pack Access Retrieval and Transit (DPART) systems were busy repositioning equipment and cargo on the decks while the prepo ships were underway. This will ensure the immediate offload of the specific equipment that TF 11 will need upon arrival.



She wants the current status. Her prepo ship dashboard status screen tells her 90 percent of the unit equipment and sustainment stocks have been repositioned in offload order; and 100 percent of the lighterage and equipment needed for the JLOTS (joint logistics over the shore) offload operation have been offloaded. The in-stream offload of the unit sets is commencing. By the time she disembarks, initial response efforts will be underway.

¹³ Sea State 3 equates to 3.5–5-foot waves and moderate seas, as defined by the Pierson-Moskowitz Scale, JP 4-01.6, *Joint Tactics, Techniques, and Procedures for Joint Logistics over-the-Shore*, 12 November 1998, Table G-2.

Game Changer #2: Technology

*For all the various factors that may challenge the United States in this revolution of technologies, it is also in the traditions of America, and its military, to be flexible and experiment with change.*¹⁴

P. W. Singer

Few in 2012 could have comprehended the pace of change and technological advances we enjoy in 2028. The playing out of [Moore's Law](#)¹⁵ (and the laws that followed), the rate of [technological change](#), and accelerating [price-to-performance ratios](#) all combined to underpin exponential change for just about everything—including military distribution. An example of this is how the intelligent agent-embedded smart phone applications, in their infancy in 2012, are now relatively inexpensive, found in military software systems-wide, and capable of performing extremely complex, well-informed planning and execution functions for logistics operations.

The fielding of advanced technology spurred cultural changes in the Army as new efficiencies were achieved. These technological advances drove higher expectations of our supply chain capability—with corresponding higher standards and metrics. Advancements in the field of robotics, intelligent agents, and [nanotechnology](#) created opportunities within both the logistics and operations fields. Costs to deliver these efficiencies dropped as technology matured, thus generating even more incentives to apply technology in innovative ways.

Never before could so much be achieved at such a relatively low cost. Soldiers raised in a culture of pervasive technology pushed the Army to catch up and proved adept at acquiring, adapting, and integrating technology for the broader use Army-wide. Today, we have Soldiers who cannot imagine the “dark ages” of the iPhone. Who would have thought that Steve Job’s inventions would be rendered obsolete so quickly?

CASCOM fostered an environment that encouraged innovative solutions that overcame old parochialisms and embraced new technologies. Our Soldiers and government civilians are more flexible, efficient, and effective because of how we target the use of technology.

* * *

In 2028, the “realm of possible” has become a reality in terms of technology and its application on the battlefield. The following vignette highlights how our distribution non-commissioned officers have leveraged technological change in leading complex missions, enabled by advanced tools, doctrine, and training.

¹⁴ *Wired for War: The Robotic Revolution and Conflict in the 21st Century*, P.W. Singer (Penguin, 2009), p. 259.

¹⁵ Nearly 40 years ago, Intel co-founder Gordon Moore forecasted the rapid pace of technology innovation. His prediction, popularly known as “Moore’s Law,” states that transistor density on integrated circuits doubles about every 2 years. See <http://www.intel.com/about/companyinfo/museum/exhibits/moore.htm>, accessed 23 January 2012.



Technology enhancements changed how we enable the movement and maneuver and sustainment functions.

5 September 2028—SSG Jones is in his staging base preparing to lead a convoy on a resupply mission. Under his command is a combination of manned and unmanned vehicles loaded with multiple classes of supply for a forward operating base (FOB). Also available are intelligent agent (IA)–embedded vehicle systems that are networked with other systems, giving him unprecedented situational awareness to make informed decisions. As he gears the convoy up to meet its departure time, he turns to his touch screen dashboard to verify route information and to issue a departure message to his virtual movement control center (MCC).

While en route to the FOB, SSG Jones receives a video message from his operations sergeant, notifying him of a change in mission. He must redirect his convoy to provide ammunition to an infantry platoon that is engaged with the enemy in an urban environment. As his vehicle’s intelligent agent recalculates his route, he receives intel feeds that alert him to an area along the new route that has an improvised explosive device (IED) threat. He communicates all of this to his manned and unmanned vehicles and approaches the IED zone. He calls forward his unmanned clearing vehicle and sends it through the zone, its sensors find nothing suspicious and send back an “all clear” signal. The convoy continues on to the infantry platoon. The platoon leader makes contact and gives them a safe location to loiter. SSG Jones calls forward his unmanned, hardened delivery vehicle to one of the supply vehicles, where it selectively loads the unit set of supplies needed by the infantry platoon and delivers them forward. Constructed from carbon nano-tubes, these hardened vehicles offer better ballistic protection, are significantly lighter than their MRAP predecessors, and operate using about half the energy.

Before moving on, SSG Jones receives an update from the infantry platoon that they have a badly injured Soldier and USAID worker who need evacuation. SSG Jones puts his medic in the delivery vehicle and directs it to the rally point provided by the infantry platoon. Resupply is quickly conducted and the injured Soldier and worker are moved into the hardened section of the vehicle with the medic for evacuation. On the way back, the medic links to the field surgeons from the FOB and provides video and sensor feeds of the patients, receiving step-by-step instructions from the field surgeon for stabilizing the patients. An aerial evacuation vehicle is on the way.

SSG Jones rallies his convoy and orders it to continue on with his original resupply mission to the FOB. The ammunition he just issued to the infantry platoon is automatically decremented from his inventory levels and re-requested for the FOB. The intelligent agents also coordinate with the MCC and materiel management center, which coordinate the optimal source of supply. They direct the cargo UASs to the source of supply, where they are loaded and then dispatched to the FOB—with intelligent agents executing all necessary system transactions and documentation.

An hour later SSG Jones receives a notification that the prognostics and diagnostics aboard one of his unmanned vehicles reports an electronic generator that is within 100 hours of failing. The vehicle’s IA coordinates with the FOB maintenance contact team’s intelligent agent–enabled systems to ascertain the availability of a replacement generator and ensure the contact team is tasked and ready to replace the generator upon the convoy’s arrival. It discovers zero balance for the generator from the FOB, so the vehicle’s IA finds the closest source of supply along the cargo UASs’ route. The generator is automatically requisitioned, and the IA coordinates with the MCC for the common user cargo UASs to divert en route to pick up the new generator.

Throughout the mission, SSG Jones’ vehicle-based IAs have also been relaying to the intelligence fusion center route status and threat information gathered by built-in sensors.



FOB Soldiers watch a cargo UAS ammunition delivery to augment SSG Jones’ supply convoy.

The cultural changes that allowed for maximized use of ever-evolving technology were highlighted with key technology advances in the areas of energy, unmanned distribution capabilities, and distribution and movement control capabilities.

Energy

In a ground-breaking effort, and based on the need to reduce DoD's overall energy consumption, the Office of the Secretary of Defense developed the *Operational Energy Strategy* and presented it to Congress in May 2011. Following suit, the Army began its own *Operational Energy Campaign Plan* to serve as a roadmap between operational needs and existing initiatives to reduce the Army's dependence on and consumption of carbon-based fuels, decrease greenhouse gas emissions, and reduce the demand on a logistics system struggling to meet the Army's need for fossil fuels. DoD sought to increase operational effectiveness, provide more options for fuel, and improve capability while reducing costs.¹⁶ In the years that followed, a number of initiatives and technologies were explored, including

- designing tactical vehicles to be lighter through greater application of nanotechnology,
- the development of more fuel efficient engines, and
- continued exploration of new sources of energy, like algae-based alternative liquid fuels.

Other sources of operational energy have been considered, including minimizing the requirements for batteries that power the 21st century Soldier.¹⁷ The relationships depicted in the Campaign Plan set the stage for the development of an operational energy enterprise architecture, which was the foundation for interoperability standards, metrics, and an operational energy management system.

Unmanned Distribution Capabilities

Technological advances in cargo unmanned aerial systems (UAS) and [unmanned ground vehicles](#) (UGV) continue to amaze. Ideas previously reserved for science-fiction thrillers have become reality. Very few imagined the extent the Army would incorporate unmanned platforms when, in 2000, [Senator Warner](#) challenged DoD to field one-third of select aircraft and ground vehicles as unmanned systems by 2010 and 2015 respectively.¹⁸



Unmanned cargo platforms have become an indispensable part of how DoD supports and supplies its forces. The ability to eliminate vehicle cabs, and redistribute weight and space requirements as a result, opened up

Remotely operated vehicles proved their utility in Operation Iraqi Freedom and Operation Enduring Freedom and inspired the next-generation cargo UGV.

¹⁶ Deputy Secretary of Defense, *Energy for the Warfighter: Operational Energy Strategy*, May 2011, p. 9.

¹⁷ *Ibid.*, p. 4.

¹⁸ U.S. Senate Committee on Armed Service press release, 10 May 2000. FY 2001 National Defense Authorization Bill directed DoD to develop and field unmanned air and ground systems with a goal of within 10 years, one-third of operational deep strike aircraft would be unmanned, and within 15 years, one-third of ground combat vehicles.

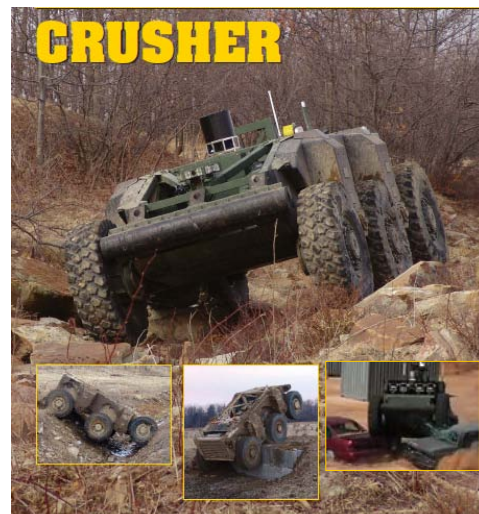
the opportunity to expand and harden the cargo areas and to install selective offload capabilities. We are able to load up several classes of supply and operate as mobile resupply points—changing missions en route and delivering what is needed at the point of employment.

Cargo may be in any configuration: break-bulk, palletized, rolling stock, or containerized. Cargo is monitored through the communications mesh that grew from the radio frequency identification technology of the late 1990s. This automatic identification technology became a more advanced capability based on rapidly advancing wireless sensor mesh network technologies.

Class IX deliveries have changed significantly, as well. Instead of having to ship parts, selected unmanned parts manufacturing platforms carry a DDM machine. The majority of spare parts are now ordered and “printed” using this three-dimensional printing equipment, which uses a special medium and a binding agent to create an exact replica of the original part.

Nanotechnology revolutionized DDM into what experts have called “molecular manufacturing.” [Molecular manufacturing](#), which binds atomic and subatomic particles until they form the desired object, provides the capability to produce many of the end items that, in the past, would have had to be manufactured, warehoused until needed, and then transported to the point of employment. Molecular manufacturing enables us to produce almost any object or compound in just minutes.

Following the passage of the 2012 [Reed-Ayotte Initiative](#)¹⁹ to combat wasteful defense spending, Congress approved a reduction in the minimum required strategic airlift assets from 316 to 301. While this saved limited maintenance resources, it ensured a higher than average utilization rate for the remaining aircraft in the strategic airlift fleet to meet a consistently high operational tempo. Changed laws facilitated increased use of the Civil Reserve Air Fleet which helped the air industry survive and flourish while minimizing the investment the DoD needed to place in traditional lift capability; thus allowing for more focused investment in capabilities to defeat anti-access and area denial threats.



Transformational manned and unmanned platforms are indispensable as DoD deploys, supports, and sustains its globally dispersed forces.

¹⁹ Senator Jack Reed, *Reed, Ayotte Introduce Bipartisan Bill to Trim Waste in Defense Budget*, press release <http://reed.senate.gov/press/release/reed-ayotte-introduce-bipartisan-bill-to-trim-waste-in-defense-budget>, released 14 October 2011, accessed 27 December 2011.

Research and development efforts began focusing on lighter-than-air platforms as a cost effective, yet efficient, solution to decrease the stresses on the fixed wing fleet. Resembling the airships of the 1920s, the hybrid heavy lift platforms completely overshadowed their predecessors. The hybrid airships, which combine the characteristics of both heavier- and lighter-than-air aircraft, have a rigid frame and ascend, descend, and maintain altitude based on their buoyancy, and employ some form of propulsion. They can be either manned or remotely piloted based on the characteristics of the mission. They also are capable of transiting inter- and intratheater distances to deliver an operationally significant force. The performance characteristics of the hybrid airships are impressive; they are capable of carrying payloads of up to 500 short tons at cruising speeds that range from 70 to 100 knots over distances up to 5,000 nautical miles. Primarily used in an airdrop role for Army missions, they are also capable of air-land operations under certain conditions. The fuel savings and reduction in carbon emissions greatly reduce their carbon footprint; therefore, they provided DoD significant savings on maintenance and operational costs.

Significant progress has also been made in adapting commercial autonomous unmanned vehicle technology within military vehicles. The concept of driverless convoys steadily moved from the realm of the possible and into reality. Initial unmanned ground vehicle efforts expanded on past successes of the Defense Advanced Research Projects Agency's (DARPA) Grand and Urban Challenges of 2004, 2005, and 2007.²⁰

The success of several automotive companies²¹ that were testing unmanned and autonomous vehicles on public roads by 2011 proved the technology and began to ease public fears and anxieties about sharing the road with robot-driven cars. In 2012, autonomous technology was already available on showroom floors—Ford had its active park assist²² and Mercedes had its collision avoidance system.²³ Google continued to make progress towards the goal of 1 million accident-free miles in its Toyota Prius autonomous test cars.²⁴ Adding autonomous vehicle technology to Army truck and support units was a natural evolution that increased unit capability, capacity, and versatility without adding Soldiers.

²⁰ DARPA Grand & Urban Challenge summary, <http://archive.darpa.mil/grandchallenge/>, accessed 23 January 2012.

²¹ See "Technology: The Realm of the Possible" graphic for links to technology demonstrations.

²² Ford Active Park Assist system, <http://www.ford.com/technology/>, accessed 23 January 2012.

²³ Mercedes DISTRONIC Plus system, http://www.mbusa.com/mercedes/innovation/advanced_technologies/overview, accessed 23 January 2012.

²⁴ Google autonomous vehicle, <http://www.leftlanenews.com/googles-autonomous-car-target-1-m-accident-free-miles.html>, accessed 23 January 2012.

Distribution and Movement Control Capabilities

The information about the package is as important as the package itself.

FedEx founder and Chief Executive Officer, Fred Smith, 1978

The capability to deliver the right item, in the right quantity, at the right time, to the right location, in the right configuration and packaging—and knowing at all times where the item was within the “end-to-end” distribution pipeline—remained elusive in 2012.

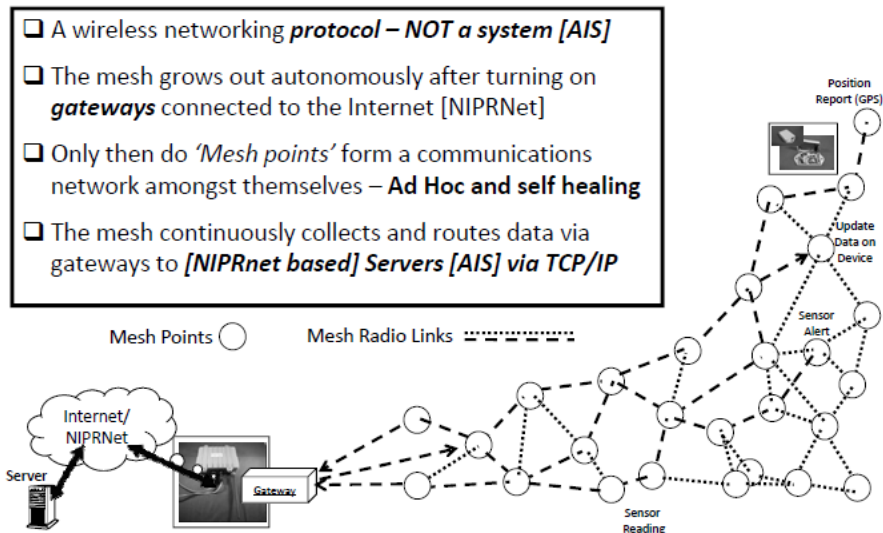
OIF, OEF, and the operations that followed spawned new distribution concepts, organizations, doctrine, and policies that were aimed at seamlessly managing this complex undertaking. Yet, in 2012, seams remained. We had yet to achieve horizontal and vertical integration from origin to the point of employment and back again. Technology allowed us to take the knowledge and experience of our transportation movement specialists and our maintenance and materiel management experts and forge it into powerful, useful, and systemic tools. Advances in technology also fueled the massive overhaul of GCCS-J and JOPES, which finally included a functional interface with JIIM-NC shipping and supply systems. Once the command and control arrangements and authorities were locked down, the real game changer for movement control and distribution was embedding intelligent agents into our management systems. These systems began developing, executing, tracking, and modifying deployment and movement plans for all phases of operations, including retrograde and redeployments. For example, CASCOM’s wholesale revision of operational logistics (OPLOG) planner evolved from a static database tool to a “smart” integrated application that accounts for JIIM-NC logistics capabilities and draws accurate, near-real-time data to plan sustainment support for military operations.

The quantum leap in sophistication and integration, with the incorporation of intelligent agents into our supply chain and distribution network, was nothing short of phenomenal. **The challenge then became how to train our leaders to effectively manage so many moving parts and changing missions.**

Movement control was also a challenge; synchronization of all modes of military and commercial transportation, including associated policy, business rules, processes, systems, and technologies took time to develop. Delegating the decision making to the intelligent agent-enabled systems drove movement control advances in process and flow design.

The necessary synchronization and integration of authorities and process improvements came about through Secretary of Defense guidance, post-OIF/OEF [fiscal austerity](#), and candid, hard-hitting lessons and recommendations from our movement control community. The Surface Deployment and Distribution Command (SDDC) now serves as the inter-to-intra-theater bridge between the strategic and operational levels. SDDC also facilitates the inter-to-intra-theater hand off with and among geographic combatant command stakeholders. Deployment and distribution stakeholders—or rather, their systems—collaborate in the shared space between movement and maneuver and sustainment to integrate distribution and movement control with operational requirements.

Technology enhancements, including “mesh technologies,” changed how we enabled the movement and maneuver and sustainment functions. Mesh technology in the form of ever-smaller tracking devices permitted the real-time visualization of sustainment along the logistics pipeline and forces on the battlefield.



With the advent of wireless sensor mesh networks, knowing—at all times—where an item is within the pipeline became prevalent.

Container management was another challenge for the Army of 2012, but Soldiers chasing containers on the battlefield with clipboards and handheld scanners is now a distant memory. Smart containers and cloud-based in-transit visibility (ITV) [mesh](#) technology finally allowed for real-time automated tracking and intrusion monitoring via satellite and networked systems. Smart container monitoring applications²⁵ replicated technology proven in the commercial shipping industry and allowed military users to track, monitor, and divert shipments as operations dictate.

Some technologies that existed before 2012 just needed to be procured and fielded. Some were working prototypes, but many were merely conceptual, albeit within the realm of the possible. In 2028, we enjoy an integrated and focused common operational picture of everything moving in the battlespace throughout the strategic, operational, and tactical continuum.

Trust and confidence in intelligent agent capability is now pervasive. But faith in a supply chain that does not stockpile or hoard took a concerted effort by logisticians and operators alike.

²⁵ FedEx example, <http://www.senseaware.com/>, accessed 23 January 2012.

Game Changer #3: Organizational Changes and Investment in Our People

Technology offers the opportunity for paradigmatic changes, but how you employ it is the real game changer. Although our Army leaders pushed for institutional game-changing technologies and ideas, they were relentless in developing well-trained Soldiers, civilians, and leaders who were enabled by technology and who helped transform how we move, maneuver, and sustain the Army.

With budgets slashed in the years following 2012, the Army focused efforts with laser precision to maximize effectiveness and versatility. That precision included targeting force structure cuts, keeping and redesigning critical capabilities, and accelerating the testing and rapid insertion of technologies. We maximized our Soldiers' capabilities and effectiveness through technology insertions.

Organizational Changes

Although technology drove change, organizational improvements were made that leveraged both technology and process improvements to create more dynamic and capable options for the geographic combatant commander. As an example, the nascent criticality of overcoming the threat



of anti-access and area denial strategies employed against us was a harbinger of things to come. Anti-access and area denial attacks became prevalent, and strategies to protect against them became a requirement.

Organizational implications came with the development and fielding of the long-loiter hybrid [airships](#), which enabled a transformation in airborne operations and were uniquely suited to counter anti-access and area denial strategies. The use of airships, coupled with force structure trades that

produced additional Army airborne brigades, produced a synergy that enabled airdrop and airland operations on a scale unimagined in 2012.

The airships provided capabilities akin to a “mobile green ramp,” whereby paratroopers, their equipment and sustainment stocks load, stage, and loiter until they are needed. These platforms facilitated

- the ubiquitous resupply of globally deployed airborne Soldiers;
- platform to platform mid-air transfer;
- en route mission reconfiguration, planning, and rehearsal; and
- rapid extraction, redeployment, and re-employment elsewhere.

Airships provided significant distribution capacity to offset reliance on ground-based distribution operations. We leveraged their autonomous, unmanned, configured load-building, and long-loiter supply and distribution capabilities as part of the pre-positioning fleet of assets. This expeditionary intermodal operational paradigm has been adapted and implemented for deployment, distribution and sustainment operations Army-wide.

Another organizational shift occurred in the ground domain, with the investment in robotics and UGV as a means to mitigate the risk associated with post-OIF and OEF force structure cuts.²⁶ Projected economies of scale pushed the fleet cost for the UGV technology to less than \$20,000 per vehicle.²⁷ UGV modifications maintained enough flexibility to have a Soldier drive the vehicle, providing options for accomplishing missions throughout the logistics continuum. Of course, without a Soldier in the cab, we could design “cab-less” sustainment vehicles embedded with autonomous technology. Designs decreased vehicle cost and weight but increased reliability,²⁸ mobility, and cargo capacity. One prototype was the remarkably successful [Crusher](#).²⁹

As we developed, tested, and fielded a UGV “future” truck company, what was thought to be just within the realm of the possible was actually too conservative, and the Army quite rapidly added the technology to its truck units. All truck companies now include traditional squads as well as UGV-equipped squads. By adding both capability and capacity, these advancements made our logistics units even more efficient and effective.

Investment in Our People

Organizational changes decreased the number of Soldiers per unit and civilians per organization, but they expanded the scope of responsibility for all. Today’s Soldiers (and in many cases, our civilian counterparts in the battlespace) must manage fluid missions with increased information flow and virtual capabilities.

This was no easy job, but our Soldiers, civilians, and young officers exceed expectations, mainly thanks to the quality of continuous training the Army provides. Virtual, immersive, networked training can happen anywhere, and we have the ability to learn from the enemy’s adaptation to our techniques in real time. We’ll never allow them to hit us twice in the same way!

* * *

The following vignette highlights the return on investment in human capital. Career paths, professional education and capabilities, and insights garnered through operational experience of logistics Soldiers, non-commissioned officers (NCOs), and officers, have combined to shape the Army’s 2028 leadership.

²⁶ Description of various “sequestration” scenarios for Army end strength, “How the pending defense cuts could play out,” <http://www.armytimes.com/news/2011/12/army-how-pending-defense-cuts-could-play-out-120311/>, Lance M. Bacon, 3 December 2011.

²⁷ 2011 unofficial projection by one of the DARPA Urban Challenge participants.

²⁸ Through improved self diagnostics that automatically notify maintenance personnel via a “mesh” technology network.

²⁹ DARPA & Carnegie Mellon University, National Robotic Engineering Center.

1 July 2028—Brigadier General Johnson walks to the parade field. In a few minutes, he will accept the flag of his Expeditionary Sustainment Command (ESC). He reflects on his path and is retrospective on the leadership training he has received and his operational experiences leading to this day. His career has been vastly different from his predecessors. As a 2LT during OIF, he gained valuable experience in convoy operations and observed early military applications of unmanned and remotely operated vehicles.

His Haiti deployment during his 1LT days was his first “no-notice” deployment. Along with learning how to rapidly deploy on short notice, he gained JIIM-NC operational exposure. He decided to stay on active duty and take advantage of an initiative in conjunction with his advanced course—affording him an opportunity to earn an accredited master’s degree in supply chain management. After company command, he was selected for training with industry, garnering priceless experience in commercial best practices for intermodal distribution, how to rapidly insert technology into the supply chain, and in doing business with the government from a commercial partner’s perspective.

His operational experiences as a Major and LTC were surreal; reacting to nuclear attack in the continental United States³⁰ was something he never thought would happen. But, the damage inflicted on the nation created the hardened, JIIM- NC-integrated supply chain and improved force projection capabilities that allow us to assist in humanitarian and disaster relief efforts and to quickly respond to threats against our security.

As a commander of an Army field support battalion, he grew to understand the value of certifying all logistics lieutenants and midgrade NCOs as contracting officer representatives; with much of the force focused on warfighting, logisticians have learned how to quickly and efficiently ramp up contracted support. He garnered even more JIIM-NC expertise with his time as a staff officer at the Defense Logistics Agency and the deployment with the Deployment and Distribution Operations Center supporting USCENTCOM during the various scuffles over the Strait of Hormuz.³¹

Before going off to brigade command, he benefited greatly from the deployment, redeployment, and distribution track that had been added to his pre-command course (PCC). Following his brigade command, he was tasked to deploy for a year and lead an interagency delegation to USPACOM. He is one of the first general officers selected under the new requirement to be Joint-qualified and either interagency, intergovernmental, multinational, non-governmental, or commercial organization-qualified.

He thinks about the lieutenants and NCOs he will lead in the ESC and how the wholly immersive, virtual training environment they enjoy allows them to be supply chain scientists—with a much stronger knowledge earlier in their career. With continued high operational tempo, the ability to train and educate while deployed has proven to be invaluable in this continuously changing environment.

Achieving the goal of a smaller and more capable Army required more than the adoption and employment of the latest technology. Critical to our success were Soldiers and leaders who could adapt and thrive in complex, technology-infused environments, executing missions across the operational spectrum. We needed functional experts as well as savvy supply chain integrators and intermodal experts. The status quo was not good enough. Professional education and training initiatives spanned the ranks, providing Soldiers and leaders alike with a foundation in logistics science and the mental agility to apply logistics art in overcoming “Murphy’s Law” when the original calculus changed. CASCOM’s partnerships with the Training and Doctrine Command (TRADOC) and academia yielded several initiatives that paid dividends for the future force.

³⁰ Loosely based on scenarios developed in the *Seven Deadly Scenarios; A Military Futurist Explores War in the 21st Century*, Andrew F. Krepinevich, 2009.

³¹ Ibid.

Integration of the Whole Force through Training and Education

We adjusted our education tracks for all levels. Senior leader development now has an operational-to-strategic focus related to Army distribution operations, supply chain optimization principles, and JIIM-NC environmental framework. This framework is now part of Sustainment Brigade, ESC, and Theater Sustainment Command (TSC) PCCs. CASCOM partnered with the Industrial College of the Armed Forces Supply Chain Management and Transportation Industry Study programs to conduct senior-level research on contemporary supply chain and transportation issues; research paper outcomes are formally presented to the Army G-4 and other senior logisticians.

The focus of mid-career development for officers, senior warrant officers, and NCOs is on the tactical to operational levels. Selected applicants earn a Master's of Science in Logistics as they complete their respective career course. The curriculum has a common distribution core with three additional concentrations: deployment and distribution, supply chain, or lifecycle maintenance. Our partnership with select universities yields an accredited degree by

- balancing distance learning with accredited classroom instruction,
- incorporating commercial best practices (study and onsite visits),
- emphasizing the “science” of supply chain management into our Logistics Corps, and
- requiring research papers related to the selected degree concentration (a military or commercial topic or challenge).

The tactical focus for our Soldiers and junior leaders is based on an [immersive virtual training](#) environment in which simulators are mobile and easily adjusted to reflect current challenges and lessons learned. CASCOM also pursued two initiatives to address the rapid growth of unmanned ground vehicles and the continued proliferation of contracting throughout all operations:

- A UGV Center of Excellence centralized and formalized previously ad hoc remotely piloted vehicle training and doctrine development.
- Contracting officer representative training and certification added to all logisticians' professional education. In addition to their functional expertise, our junior leaders know how to interact with, work with, and supervise contracted assets, true force multipliers for the total force.

Our wholesale investment and adaptation of e-learning and mobile digital training modules not only ensured training of the most relevant, up-to-date information, but also had second- and third- order effects. First, it increased Soldier and family stability with decreased the need to move for training purposes. It also increased the opportunity of our Army Reserve and National Guard to maximize collaborative and immersive training opportunities for a larger percentage of all Soldiers and JIIM-NC partners. This lowered the train-up time required for these Soldiers and units and lessened the impact of their mobilizations and deployments on their families and civilian employers and allowed more integration of all components of our force.

The value of our investment in our people is demonstrated in the success of our operations.

Moving Forward from 2012

As the sun set on OIF/OEF, Army leaders seized on opportunities to shift the paradigm and strengthen the concept of unified action. Unified action became increasingly critical because any technological advantage was fleeting; our adversaries were concurrently designing new technologies, counterfeiting or stealing technology, or simply covertly purchasing technologies to use against us. Opportunities were championed and developed, and became codified in strategy, policy and concepts, or fielded within Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, and Facilities (DOTMLPF) to provide capabilities en route to 2028. Technology helped to an extent, but the institutional and cultural changes that flourished within the Army's logistics community set conditions for the coming changes and way of war.

* * *

This paper offers a glimpse into the realm of the possible.

Consider our Army in 2012 as compared to the Army of 1996—ponder the changes to strategy, DOTMLPF, and policy that occurred over those 16 years. Today's Army is completely different than what it was 16 years ago. Our equipment is better. Our Soldiers, proven by war, are better-trained, better-equipped, and technology-enabled. We have accomplished much.

Now, fast forward another 16 years to 2028. Given an exponential increase in the pace of change and advancement of technology, bold logisticians will produce the game changers described in this paper, as well as other solutions that we cannot yet imagine to counter threats we have yet to consider. Our Logistics Corps will ensure the Army of 2028 possesses an unmatched, versatile mix of capabilities to sustain any type of operation and mix of JIIM-NC partners. The challenge is to decide what we want our future to look like, and then to make it happen.

The following sections expand on ideas already presented, and describe some initiatives that our community of logisticians should explore to begin to build the bridge to the future and fully enable the sustainment and movement and maneuver capabilities of 2028. Some are within CASCOM's span of control; others must be championed and influenced by logisticians, but ultimate execution may occur under another JIIM-NC organization's purview.

There are those that look at things the way they are, and ask why? I dream of things that never were, and ask why not?

Robert F. Kennedy

Promoting a Change in Culture

Success depends on a culture that embraces change.

Critical to any change as we move forward are adoption of the recently released Defense Strategic Guidance³² and active collaboration within the JIIM-NC community. The following are potential opportunities to begin the dialog and examine the way ahead:

- Host JIIM-NC sustainment symposia to bring together thought leaders.
- Recommend establishment of joint program offices as necessary (i.e. for development of platforms to conduct waterborne operations and unmanned vehicles).
- Fully embrace the need for adaptation and versatile, living, interactive, and collaborative doctrine, particularly in the areas of
 - expeditionary intermodal operations (platforms and enablers across all domains—watercraft, rail, truck, aerial, container, material handling, space, etc.),
 - an Army robotics concept of employment in support of logistics operations, and
 - autonomous and semiautonomous robotic vehicle employment.
- Develop policy to move from hydrocarbon-based military to alternative powered military (hydrogen, solar, biofuels, etc).
- Analyze how advancements in one functional area affect the overarching supply chain, and ensure synchronized capability development efforts accordingly.

Harnessing Technological Change

Technology offers unlimited opportunities. It will be necessary to continue and expand on the following initiatives, remember they only offer a starting place:

- Pull historical data from the last 10 years of conflict and operations to develop updated forecasting models and planning figures, allowing for constant update to reflect the impact of technological advances.
- Integrate supply, deployment, and distribution systems into one system by merging stock/inventory and demand data into one common DoD database.
- Encourage CASCOM-driven joint capability technology demonstrations to produce
 - a UGV truck company;
 - unmanned lighter-than-air orbiting vehicle platforms that can be landed, be docked together, or drop pre-configured loads of several classes of supply where needed;
 - smart containers; and

³² *Sustaining U.S. Global Leadership: Priorities for the 21st Century*, January 2012, http://www.defense.gov/news/Defense_Strategic_Guidance.pdf.

- intelligent agent–enhanced smart phone applications across sustainment functions, such as
 - o condition-based maintenance,
 - o movement control integration,
 - o supply forecasting and optimization, and
 - o en route mission planning capability.

Implementing Organizational Changes and Investing in Our People

Most importantly, we must revamp our organizations and invest in our most valuable commodity, our people:

- Develop an immersive Joint Sustainment Training Environment at Fort Lee. Garner “best of breed” logistics training techniques and simulations, and increase collaboration and interoperability among the Services.
- Develop deployable, interactive, adjustable training modules to continue training and implement lessons learned in theater in real time.
- Develop a center of excellence for UGV training.
- Initiate senior NCO and lieutenant certification as contracting officer representatives.
- Develop a Deployment and Distribution track for the Pre-Command Course for TSC and ESC commanders.
- Develop a Master’s of Distribution/Supply Chain Management track for officers and civilians at the mid-career level.
- Develop a professional career track for officers and civilians as whole-of-government and supply chain experts.
- Measure, report, and maintain visibility of deployment and distribution readiness.

Lingering Questions

This paper was developed to generate thought and discussion. But, as we wrote and thought about 2028, we realized we still have many questions. As the Army's logisticians, we must take a measured approach to addressing these lingering thoughts, concerns, and ideas to continue this journey to 2028. With that in mind, we offer the following questions to continue the discussion:

- How wide is wide area security, particularly in regard to logistics? Is it enterprise-wide? Global? Does it include the industrial base, strategic movements, etc.?
- What will the future industrial base look like?
- What is Army policy for integrating autonomous capabilities into the Army?
- What will Army Force Generation (ARFORGEN) look like 10 years from now? As the Army works to reduce costs and cut force structure, what strategies will it use to ensure readiness and expanded capability and capacity?
- Do we need to reconsider the command and control relationships outlined in the unified command plans? Will our historical supported/supporting commander relationships adjust as we refocus our strategies on different threats and regions of the world/universe?
- How do we best incorporate technologies that enable our systems? How do we reduce the impact of human data entry error?
- How do we develop new forecasting tools based on more than 10 years of data and changing systems and drivers of requirements?
 - Can we develop metrics to measure our success and short-comings in operational terms, as opposed to business efficiencies?
 - What are the new metrics for the Operational Logistics Planner (OPLOG Planner) in the future (convoy integration metrics, contractor management metrics, etc.)?
- How do we integrate our systems and processes with other government agencies and our civilian counterparts?
- Who are the integrators of the supply chain and maneuver at the strategic, theater, and tactical levels? Should Title X responsibilities change and if so, how? How will we achieve logistics interoperability across the DoD?
- What are logistics paradigm shifts of the future?
 - Energy
 - Capability to build redundancy and resiliency into the system
 - Extent to which we empower intelligent software agents versus human decision making.
- What will doctrine look like in 2028? Can it keep up with the pace of change?

The three game changers outlined in this white paper will continue to affect logistics capabilities at an unimaginable, exponentially faster rate. If you are reading this, then you are on the premier team of committed and innovative professionals who believe that support for the future starts now. We are on this journey together to find the best path to that future. Your participation in the dialog is critical and encouraged.

The point of contact for this paper is the Office of the Chief of Transportation, (804) 765-7444. Go to www.discoveringdistribution.org to contact us, share your ideas, and join the professional discussion. Army Strong!

The only way of finding the limits of the possible is by going beyond them into the impossible.

Arthur C. Clarke

Appendix A. Abbreviations

ARFORGEN	Army Force Generation
CASCOM	Combined Arms Support Command
DARPA	Defense Advanced Research Projects Agency
DDM	direct digital manufacturing
DoD	Department of Defense
DOTMLPF	Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, and Facilities
DPART	Dense Pack Access Retrieval and Transit
EMP	electromagnetic pulse
ESC	Expeditionary Sustainment Command
FOB	forward operating base
FORSCOM	Forces Command
GCCS-J	Global Command and Control System–Joint
IBCT	infantry brigade combat team
IED	improvised explosive device
ITV	in transit visibility
JIIM-NC	Joint, Interagency, Intergovernmental, Multinational, Nongovernmental and Commercial
JLOTS	Joint logistics over the shore
JOPEs	Joint Operation Planning and Execution System
MCC	movement control center
MEV	maneuver enhancement vessels
MRAP	mine-resistant, ambush-protected
MUSCL	modular unmanned surface craft, littoral
NCO	noncommissioned officer
OEF	Operation Enduring Freedom
OIF	Operation Iraqi Freedom
OPLOG	operational logistics
PCC	pre-command course
SCoE	Sustainment Center of Excellence
SDDC	Surface Deployment and Distribution Command

TF	task force
TRADOC	Training and Doctrine Command
TSC	Theater Sustainment Command
UAS	unmanned aerial system
UGV	unmanned ground vehicle
USAFRICOM	United States Africa Command
USAID	United States Agency for International Development
USCENTCOM	United States Central Command

March 2012

“To improve is to change; to be perfect is to change often”
—Winston Churchill

What are the future game changers?

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