



WHITE PAPER

# Achieving **Next-Generation Defense Logistics** with Artificial Intelligence

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# Executive Summary

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Logistics is essential to maximizing warfighting readiness and operational effectiveness, directly linking logistics to national security, mission success, and conflict deterrence. While the U.S. has enjoyed a competitive advantage in logistics since World War II, factors such as antiquated information systems, the dynamic nature of modern warfare, and technologically advanced near-peer adversaries threaten the current logistics enterprise. The modern battlefield calls for an agile, resilient, and responsive logistics enterprise, only made possible with artificial intelligence (AI).

To modernize the logistics enterprise, Tagup has developed Manifest, a software platform that uses machine learning (ML) to enable next-generation defense logistics. Manifest empowers logisticians and commanders to harness predictive modeling and simulation capabilities to anticipate logistics needs and guide strategic, mission-critical planning efforts. Despite the potential friction points in the adoption of AI software for defense logistics, including data quality and access, security and vulnerability, and impact on personnel, there are several mitigation strategies that can overcome these barriers to provide for a modernized logistics enterprise.

With near-peer adversaries rapidly embracing AI for defense logistics, the time to modernize our logistics enterprise is now. Manifest makes the logistics enterprise of tomorrow possible today.



# The Challenges Facing Defense Logistics



**Infantry wins battles, logistics wins wars.**

**U.S. Army General John J. Pershing**

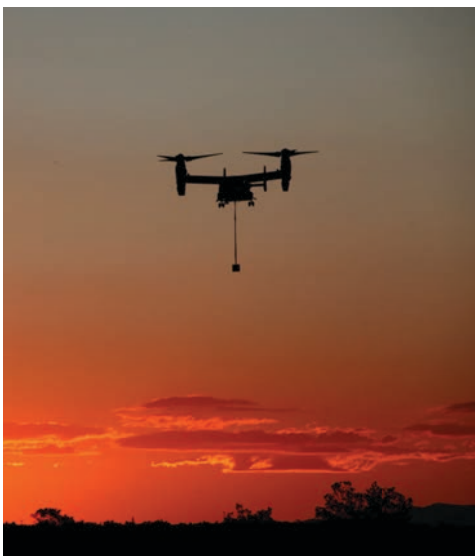
Commander of American Expeditionary Forces, World War I

As General Pershing's quote suggests, logistics is the foundation of military power. A force superior in size and capability will struggle without the right supplies in the right place at the right time. We need look no further than Russia's failure to capture Kyiv in the early stages of its invasion of Ukraine, where lack of fuel and food contributed to Russia abandoning its pursuit of Kyiv and prioritizing eastern areas already under dispute.<sup>1</sup> Additionally, nearly one-third of the tanks Russia has lost were captured or abandoned,<sup>2</sup> which experts attribute to logistics failures, especially fuel shortages.<sup>3</sup>

Effective logistics is critical to military success. However, several challenges threaten the current U.S. logistics enterprise.

## Siloed Information Systems & Lack of Predictive Capabilities

Military logistics produces a wealth of information, including transactional data, consumption rates, and fulfillment data. In fact, there are over 8 million active National Stock Numbers (NSNs)<sup>4</sup> across ten classes of supply. These are distributed to over one thousand military installations – over 300 domestically<sup>5</sup> and over 750 abroad in 80 countries.<sup>6</sup>



However, it is difficult to use this data at scale because data relationships are too complex for routine calculations and data is fragmented across siloed information systems. For example, the Defense Logistics Agency (DLA) manages over 70 applications<sup>7</sup> and the Marine Corps logistics enterprise has over 100 information systems.<sup>8</sup> While some users have built bespoke tools to aggregate and analyze data, these tools rely on heuristics and are not predictive in nature. Accordingly, the scale and scope of military logistics data means that analysis can only be done at a very high-level, ignoring critical details and nuances, or a very low-level, optimizing locally without considering the “big picture”.





## Customer Wait Time & Fill Rate

While customer wait time (CWT) in the private sector averages 1.23-2.62 days,<sup>9</sup> CWT in the military tends to be much longer. For example, the CWT goal for the Army is 10 days for the contiguous U.S. (CONUS) and 15 days for outside the contiguous U.S. (OCONUS).<sup>10</sup> However, data from 2016 shows that, in extreme cases, CWT can reach multiple years.<sup>11</sup>

Similarly, fill rates in the military tend to fall below fill rate benchmarks of the private sector, which are typically between 85% and 95%.<sup>12</sup> For example, the fill rate goal for the Army Supply Support Activity (SSA) is 60% for maintenance significant parts (MSP) and 35% for all other supplies.<sup>13</sup> Low fill rates and the inability to meet demand lead to suboptimal equipment and operational readiness.

## The Dichotomy of Inventory Overstocking & Shortages

The implications of this lack of predictive modeling, long CWT, and low fill rates lead to two key outcomes:

1. Overstocking and underutilization of supplies and equipment; and
2. Shortages of critical supplies and equipment.

The first implication—overstocking—leads to significant budgetary waste and misallocation of resources. As seen in August 2021, the U.S. left behind \$7 billion in military equipment after the withdrawal from Afghanistan,<sup>14</sup> placing weapons and equipment into the hands of the Taliban. The withdrawal exhibited several conditions that would make logistical demobilization planning particularly challenging: two decades worth of equipment and supplies to transport, a rapid withdrawal timeline, and lack of visibility into placement of equipment and supplies given a history of inventory tracking issues.<sup>15</sup>

The consequences of the second implication—shortages—are injuries and, in extreme cases, the loss of human life. A post-mishap water intrusion test conducted on the assault amphibious vehicle (AAV) that sank in July 2020, killing eight Marines and one sailor, found that a significant amount of water leaked through the intake and exhaust plenum grills as well as a missing headlight connector on the front bow into the engine compartment.<sup>16</sup>

Thus, the limitations of the current logistics enterprise lead to overstocking, resulting in substantial wastage and empowerment of our enemies, and shortages, resulting in diminished readiness and, in extreme cases, catastrophic outcomes, including the loss of human life.

## The Evolving Modern Battlefield

The previously explored challenges are exacerbated by the evolving nature of modern warfare. Traditional “iron mountains” of stockpiled materiel will be a liability on the modern battlefield. Not only is their static nature in direct opposition to the dynamic nature of modern warfare, but they are increasingly becoming enemy targets<sup>17</sup> as adversaries seek to threaten the logistical foundation of U.S. military power. The U.S. will need to fight to preserve logistics operations on the modern battlefield. While the U.S. has not had to apply combat power to preserve logistics capabilities in Afghanistan and Iraq over the last two decades, the contested logistics environment of the modern battlefield means that the U.S. will need to sustain forces while adversaries are actively seeking to disrupt logistics operations.<sup>18</sup>

Additionally, increased demand from U.S. allies, rising geopolitical tensions, and a trend of diminishing on-shore production capacity have strained the U.S. supply chain. For example, only a single factory in the U.S. can produce the black powder needed for the most widely used Ukrainian artillery shells.<sup>19</sup> Furthermore, a January 2023 report found that even under surge production rates, it would take over five years to rebuild several categories of inventory provided to Ukraine, including projectiles, Javelin missiles, and Stinger missiles.<sup>20</sup> Such vulnerabilities could be targets for adversaries to exploit.







## Adversarial Adoption of AI

Near-peer adversaries are rapidly embracing emerging technologies and AI for military applications, particularly in logistics. In fact, China is investing in AI for military logistics at a rate nearly three times that of the U.S., with 16% of its military AI contracts awarded for logistics compared with 6% for the U.S.<sup>21</sup> Although the U.S. defense budget is nearly 4x that of China (2024 budgets total \$886 billion<sup>22</sup> vs. \$232 billion<sup>23</sup> respectively), the Chinese military's AI investments are estimated to be equal to or greater than that of the U.S. A 2021 report estimated the floor of Chinese AI military spending to be \$1.6 billion<sup>24</sup> compared with the \$1.8 billion requested for AI in the FY2025 U.S. defense budget.<sup>25</sup> Pairing the rate of military contracts awarded with the size of AI investments signals that China is significantly outpacing the U.S. in the adoption of AI for military logistics, which will result in disastrous near-term consequences for our nation's defense.

## Modernizing the Logistics Enterprise

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To mitigate these challenges and secure our logistical advantage on the modern battlefield, our military must deploy an agile, resilient, and responsive logistics enterprise. Current linear supply chains and static centralized depots fail to adapt with the speed of relevance necessary to address evolving threats and rapidly changing conditions on the ground. To maintain operational success and combat power, the future fight requires smaller, dispersed, and interconnected networks capable of efficiently responding to the constantly evolving battlefield and meeting the demands of modern warfare.

While the size and siloed nature of the defense logistics domain caused past AI solutions to fail, modern AI techniques can overcome these challenges, enabling the effective deployment of this modernized logistics enterprise. Harnessing the power of modern artificial intelligence techniques with the rich data the military has available can deliver efficiencies and insights that enhance operational readiness, strengthen supply chain resilience, and maximize combat power. We built Manifest to deliver these efficiencies and ensure our logistical advantage.

## Manifest: Next-Generation Defense Logistics

Tagup's Manifest platform uses AI to dynamically optimize various aspects of defense logistics, including inventory management, mobilization planning, and resource allocation. Manifest was tested and refined in close collaboration with the U.S. Marine Corps and U.S. Navy, and with on-the-ground, intimate knowledge of the defense supply chain.

Manifest unifies the tremendous amounts of logistics data siloed across disconnected information systems to build a cohesive picture of the military supply chain from the ground up. Using this rich historical data, Manifest trains ML models on logistics variables, including demand, consumption, and transportation. These models then provide predictive simulation capabilities to anticipate logistics needs and guide strategic, mission-critical planning efforts.





These models empower logisticians and commanders to:

- **Simulate contested logistics** as a function of supply policies and changes to supply, demand, and transport constraints;
- **Intelligently pre-position materiel** across supply nodes to satisfy a series of objectives (fill rate maximization, CWT minimization, cost minimization—i.e., supply optimization);
- **Optimize the materiel to be mobilized** for a given operation in order to maximize consumption rate, minimize equipment failure in the field, and minimize “short inventory”;
- **Optimize inventory levels** at the granularity of an NSN;
- **Forecast lead times** by NSN for due-in inventory;
- **Project potential/future readiness** based on user-specified parameters (deployment date, duration, location, required units/capabilities, etc.);
- **Predict future stock point outages**, such as when expected consumption will exhaust supply before current policies would retrieve new stock;
- **Prioritize which blocks should be replenished** based on inventory on-hand and expected due-ins;
- **Infer expiration dates** of future materiel and track cost of expiration; and
- **Anticipate supply constraints** related to changes in materiel usage patterns or planned operations.

By optimizing these aspects of defense logistics, Manifest improves the effectiveness of four key variables:

**1. Force readiness:**

With Manifest, users can either optimize inventory to increase readiness for the same level of budget or reduce inventory costs while maintaining the same level of readiness.

**2. Budget efficiency:**

Manifest right-sizes inventory to prevent overstocking and minimize waste, enabling users to maximize readiness for a given budget.

**3. Logistician productivity:**

Manifest optimizes workloads and minimizes staff time on manual tasks, such as managing data or placing orders, allowing personnel to focus on mission-essential tasks.

**4. Decision-making:**

With Manifest, users can simulate outcomes across thousands of scenarios based on key inputs to make faster, more informed decisions, shortening the observe-orient-decide-act (OODA) loop.



## Case Study: U.S. Marine Corps 1st Medical Logistics Company



### Background

The Marine Corps 1st Medical Logistics Company, located at Camp Pendleton, CA, are custodians of Class VIII medical materiel for the Indo-Pacific region. Positioning supplies in this dynamic region is particularly complex as the area comprises over 50% of the earth's surface and over 100 million square miles.<sup>26</sup>



### Challenge

Difficulty in forecasting consumption and replenishment rates, variable CWT, and sudden changes in deployment and exercise schedules led to a suboptimal readiness level of 75%, below the target of 80%, and disposal of over \$2 million in expired materiel each year.



### Solution

1st Medical Logistics Company implemented Tagup's Manifest to optimize consumables medical inventory levels and support the positioning of Class VIII medical supplies in the Indo-Pacific region. Manifest trained bespoke ML models on years of historical data to reduce the uncertainty associated with difficult-to-predict dynamics. These include instances related to the timing of when previously ordered parts would arrive along with how much additional spending would be required to achieve a certain level of readiness.



Brothers, Tagup is worth your time! ... Think of this as a tool to help you select the right equipment for deployments, and forecast consumables and SECREP [Secondary Repairables] requirements in order to sustain said equipment.

Chief Warrant Officer 4, U.S. Marine Corps  
Motor Transport Maintenance Officer



## Results

Manifest allows users to optimize supply decisions to satisfy a series of objectives, from minimizing inventory costs at fixed readiness to maximizing readiness and fill rate at fixed budget.

With Manifest, 1st Medical Logistics Company has reduced inventory costs by over 20% while ensuring readiness targets are met. Alternatively, simulations show that 1st Medical Logistics Company could increase readiness by 13% and order fill rate by 6% at a fixed budget. In either scenario, 1st Medical Logistics Company realizes a 25% increase in logistician productivity.

**>13%**

increase in force  
readiness at fixed  
budget

**>20%**

reduction in  
purchasing costs  
at constant  
readiness

**>40%**

reduction in  
materiel handled  
at constant  
readiness

**>6%**

increase in order  
fill rate at fixed  
budget



Oh hell yes. When the MEU [Marine Expeditionary Unit] goes out, the Mobilization Planner provides the kind of data that supply and logistics planners need.

Captain, U.S. Marine Corps  
Logistics Officer

## Value to the Department of Defense

This case study demonstrates 20% reduction in purchasing costs while maintaining readiness for a single class of supply for 1st Medical Logistics Company. The potential savings are substantial when scaled across the enterprise: the Marine Corps manages approximately \$6.8 billion of Operating Materials and Supplies (OM&S).<sup>27</sup> Potential savings also scale across branches of the military: the Army manages approximately \$45 billion of OM&S.<sup>28</sup>

# Friction Points & Mitigation Strategies

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The following list highlights potential barriers to adopting AI software for defense logistics as well as mitigation strategies to address these concerns.

## **Friction Point 1: Data Quality and Access Issues**

AI and ML solutions require extensive amounts of data. Although the logistics enterprise has the vast amounts of data necessary to train and leverage ML models, data is spread across siloed information systems and is not standardized in ways that make it easy to drive value. Additionally, unbounded data collection means that meaningful data can be hidden behind redundant and unnecessary data. Preparing data to be harnessed by ML models can be difficult and time-consuming.

### **Mitigation Strategy**

Initiatives have been underway within the military for years to consolidate and retire legacy information systems. Manifest can unify data from siloed information systems to give a comprehensive picture of the supply chain and operational environment.

## **Friction Point 2: Security & Vulnerability of AI Systems**

Bureaucracy and security policies may prevent military personnel from accessing AI systems. Additionally, AI systems will increasingly become enemy targets for manipulation as they become a vital part of military operations.

### **Mitigation Strategy**

Mitigation strategies include robust security protocols, data privacy measures, and regulatory compliance to enhance resilience and protect system integrity against adversarial attacks. Tagup complies with leading industry standards and has undergone some of the most rigorous regulatory requirements to maintain data security, including SOC 2 and NIST 800-171.

## **Friction Point 3: Perception of Logistics as Guaranteed Capability**

Logistics does not have the same visibility as combat operations and is often considered an assumed capability. This perception often leads to underinvestment in logistics and its absence from discussions regarding the military's needs.

### **Mitigation Strategy**

Mitigation strategies include raising awareness of the role logistics plays in military success, and citing historical case studies in which logistics determined the outcome of military conflicts.



## Friction Point 4: External AI Systems Lack Business Understanding

Not only are the logistical needs of the military very unique from those of the private sector, but logistical needs across the branches of service vary greatly as well. Commercial-off-the-shelf (COTS) systems will not have the customization and scalability necessary to address these highly specific requirements. Additionally, there is a concern that outsourcing development of AI applications for defense logistics will also not adequately meet the needs or challenges of the military.<sup>29</sup> Nevertheless, developing these capabilities in-house presents its own set of challenges. One challenge is the current lack of recruiting and training necessary to handle future data-driven challenges in the military.<sup>30</sup> Another challenge is that those who spearhead the development of AI logistics solutions would not be the ones assessing its effectiveness and making adjustments due to billet turnover.

### Mitigation Strategy

Mitigation strategies include detailed requirements specification, engagement with subject matter experts, knowledge transfer, and iterative development. Manifest is not a COTS system and was rigorously tested, refined, and proven in close collaboration with the U.S. Marine Corps and U.S. Navy. This iterative and bespoke development process featured on-the-ground, intimate knowledge of the defense supply chain, resulting in a solution that meets the needs and challenges defense logistics faces.

## Friction Point 5: Impact on Personnel

Not only can AI software require significant retraining, but, by automating tasks, it can also result in job displacement. Such displacement can eliminate the aspect of human experience and intuition that can be critical to effectively addressing complex and quickly evolving conditions.

### Mitigation Strategy

Mitigation strategies include reskilling and upskilling programs, collaborative AI integration augmenting human decision-making, and job redesign to focus on higher-value tasks rather than repetitive, routine tasks. Manifest frees up personnel time for mission-essential tasks by automating manual logistics tasks and champions the logistician or commander's intuition by giving them the tools and information they need to make faster, more accurate decisions.





## Conclusion

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Although often taking a backseat to the kinetic end of war, logistics is a critical combat multiplier on the battlefield. A military is only as effective as the resources it has at its disposal.

As the modern battlefield continues to evolve, it is imperative that our logistics enterprise follows suit. The modern battlefield calls for a logistics enterprise that is agile, resilient, and responsive, which will be achieved with AI. Modernizing our logistics enterprise is not optional or a future undertaking. Our adversaries are increasingly embracing AI across military applications, including heavy investments in logistics. The time to act is now. Modernizing our logistics enterprise is critical to safeguarding national security, maximizing mission success, and deterring conflict.

We developed Manifest for defense logistics to make this modernized logistics enterprise a reality. Manifest represents a transformative shift in defense logistics, enabling our armed forces to achieve unmatched efficiency, agility, and precision in military operations. We're determined to use AI to give our forces an asymmetrical advantage and secure our military's position as the most powerful fighting force in the world.

### About Tagup

Tagup is a Boston-based defense technology company pioneering next-generation AI to transform how the U.S. military and private sector manage logistics and physical assets. The company's platform, Manifest, combines human expertise with proprietary Generative Reinforcement Learning™ to power real-time decision-making, optimize supply and operational performance, and deliver a decisive advantage in mission-critical environments.

#### For more information:

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