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Military Logistics

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ABSTRACT

Logistics is the aspect of military science dealing with the procurement, maintenance, and transportation of military materiel, facilities, and personnel. Military logistics encompass a vast network of diverse materials, from weapons to medical supplies and food provisions. It covers everything from procurement and transportation to maintenance, healthcare, and facility management, ensuring readiness and operational effectiveness. It also includes storage, distribution of equipment and supplies, transport of troops and cargo by land, sea, and air. Military logistics techniques have become widely deployed in the commercial world and vice-versa. This paper addresses military logistics.

KEYWORDS: *military, army, logistics, supply chain, transportation, military logistics.*

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INTRODUCTION

Logistics, the means of strategy and tactics, determines what is practically possible in war. Its nature is expressed in operational choices and decisions, and is fundamental to military preparedness. Military logistics are operating incessantly alongside the supply of goods in times of war, peace, and crisis. The four basic elements or functions of logistics are supply, transportation, facilities, and services. All involve the provision of needed commodities or assistance to enable armed forces to live, move, communicate, and fight. All of them involve the provision of needed commodities or assistance to enable armed forces to live, move, communicate, and fight. They play an important role in the success of an operation. Supply is the function of providing the material needs of military forces. Transportation is an extended process which includes the movement of personnel and materiel from the place of origin to a theatre of operations. Facilities owned by modern armies, navies, and air forces include factories, arsenals, laboratories, power plants, railroads, shipyards, airports, warehouses, supermarkets, office buildings, hotels, hospitals, homes for the aged, schools, and colleges. Services refer to activities designed to enable personnel or material to perform more effectively [1].

THE MILITARY

The defense sector is constantly evolving, driven by technological advancements and the need to adapt to emerging threats. Crucial objectives for militaries include protecting forces, increasing situational awareness, reducing soldiers' workload, and facilitating movement in challenging terrains.

The United States military has several components or branches, as shown in Figure 1 [2]. The seven branches of the US military are the Army, Navy, Air Force, Marines, Coast Guard, National Guard, and Space Force. The Army is the oldest branch, and the Space Force is the newest. The Army National Guard and the Air National Guard are reserve components of the Army and Air Force, respectively. For example, the US Coast Guard is depicted in Figure 2 [3]. The branches all report to the Department of Defense (DoD). Regardless of branch, the Army conducts both operational and institutional missions. The operational Army consists of numbered armies, corps, divisions, brigades, and battalions that conduct full-spectrum operations around the world. Institutional organizations provide the infrastructure necessary to

raise, train, equip, deploy, and ensure the readiness of all Army forces [4]. Some military personnel work in the air, some on the ground or water, and others in space.

The US system created the world's most advanced military. The United States is the leader in developing many of the new technologies. However, China and Russia—key strategic competitors—are making steady progress in developing advanced military technologies. As these technologies are integrated into foreign and domestic military forces and deployed, they could hold significant implications for the future of international security.

The US military is racing to keep up with advances by China and Russia in hypersonic weapons, which travel at five times the speed of sound or faster. In contrast to Russia and China, the United States is not known to be developing hypersonic weapons for potential use with a nuclear warhead. As a result, the United States is seeking to develop hypersonic weapons that can attack targets with greater accuracy. China's defense transformation has been guided by a principle known as "military-civil fusion," which aims to allow the state to seamlessly capitalize on private-sector advances. The United States has a finite window to up its game against China, which already uses AI in a vast domestic surveillance network and has staked out a goal of AI primacy by 2030. A factor slowing down US innovation is the Pentagon's focus on long-term investments in a small number of weapons systems, some of which do not play out as planned. China, meanwhile, tends to experiment with many versions of similar technology. Figure 3 portrays Chinese army [5].

As we approach 2040, the arena of warfare and defense stands on the brink of a radical shift, driven by swift advancements in military technology. NATO expects four core characteristics to define many key advanced military technologies [6]:

- *Intelligent* – Solutions will exploit integrated AI, knowledge-focused analytic capabilities and symbiotic AI-human intelligence, resulting in the spread of disruptive applications across the technological spectrum.
- *Interconnected* – Solutions will take advantage of the growing network of virtual and physical domains. Connectivity solutions address concerns about how combatants detect and locate their adversaries, communicate with each other, and direct operations. This will include networks of sensors, organizations, individuals and autonomous agents, linked via new encryption methods and distributed ledger technologies.
- *Distributed:* Solutions will employ decentralised and ubiquitous large-scale sensing, storage, and computation to achieve new disruptive military effects.
- *Digital:* Solutions will blend human, physical and information domains to support novel disruptive effects.

The introduction of the technologies on future battlefields will transform every aspect of combat and raise a host of challenges for advocates of responsible arms control.

MILITARY LOGISTICS

Logistics serves as the backbone of a military's power, providing an integrated system of supporting activities – including the supply, movement, and maintenance of equipment, personnel and services – that support the full spectrum of operations. It is perhaps the most complex and interrelated capability provided by today's military. Military logistics is the discipline of planning and carrying out the movement, supply, and maintenance of military forces. It is the branch of military art which embraces the details of the transport, quartering, and supply of troops in military operations. It serves as the essential "lifeblood" that enables strategy and tactics by ensuring troops have what they need, when and where they need it, to sustain any military action. The foundation of military logistics is the production and procurement of military forces. This has a direct impact on the reaction that can also mobilize a country. The core functions within logistics are supply, maintenance, deployment and distribution, health services, logistic services, engineering, and operational contract support. Military logistics is illustrated in Figure 4 [7].

Modern military logistics is now a high tech field with predictive forecasting, operations research, and the most efficient means to get the supplies where they need to be. From the farthest tactical edge to the economic system of the nation, military logistics has far-reaching implications for the nation and the military element of national power and therefore affects every aspect of organizing, training, equipping, deploying, and employing the force. Military logistics touches every aspect of military strength and is the sum of the capabilities brought to bear by all of the US military services and those of a wide array of international partners [8]. Throughout history, each powerful military either has learned to master logistics or has withered without it.

Logistics is the oxygen that allows military muscle to function, grow, and strengthen. It is the foundation for the success of military operations from entry-level

training to the most complex operations across the spectrum of conflict. Soldiers cannot win on the battlefield without weapons to shoot, tanks to maneuver, food to eat, and the logistics support to ensure those provisions get to the right place at the right time. Logistics within the military context includes planning, procurement, contract management, loading/unloading, transportation, warehousing and distribution, catering, maintenance, medical services, personnel services, etc. This is typically illustrated in Figure 5 [9].

APPLICATIONS OF MILITARY LOGISTICS

Military logistics is the crucial process of planning, implementing, and managing the movement and support of forces, equipment, and supplies (like food, fuel, ammo, medical aid) from origin to destination and throughout operations. Common areas of applications include the following [10-12]:

- *Consumer Logistics*: Consumer logistics, also called operational logistics, relates to the supply and support functions of forces. It requires the collection of the initial product, storage, transport, maintenance, operation, and disposal of materiel. Consumer logistics covers stock control, provision and construction of facilities, movement and control. Logistics in that aspect concern reliability and defect reporting, safety standards for storage, transport and handling and related training.
- *Medical Logistics:* Disease had been the greatest enemy of the soldier. Invading armies sometimes introduced diseases. Wars often created conditions for diseases to flourish through crowding, social disruption, and damage to infrastructure. Crowded army camps were always susceptible to diseases. Disease was caused by bad air and overcrowding. Malaria was a major medical and military problem in many theatres of war. During the campaign in Western Europe in 1944–1945, penicillin was widely used both to treat infected wounds and as a prophylactic to prevent wounds from becoming infected. Helicopters were used by the United States in the Korean War to deliver supplies.
- *Logistics Support:* Support of any kind of operation depends on the stored energy of the logistics system. Logistic support guarantees the success of military operations. Every peacekeeping mission is based on logistics processes. The military supply chains concern all processes needed to gather, deliver, and provide services such as transport, medical, communication, repairs, habitation, etc. Logistics activity is focusing on providing support in order to fulfil combat readiness.
- *Logistics Fulfillment:* This is essentially the reconciliation of requirements and the application of capacity, ability, and materiel. Much risk can be defined as the reconciliation between what the force needs and what it actually receives.
- *Predictive Logistics:* The transformation to predictive logistics must happen at both the tactical and strategic levels. Predictive analytics could transform how we manage our organic industrial base and collaborate with commercial suppliers. Predictive logistics can optimize what gets moved, where, and when. For example, our systems can predict when vehicle components will likely fail, based on usage patterns and environmental conditions. The potential effects of predictive logistics are strategic as well. Predictive logistics could dramatically improve our combat effectiveness while reducing costs. Transforming to predictive logistics requires changes in how we think about sustainment.

BENEFITS

Military logistics is the discipline of planning and carrying out the movement, supply, and maintenance of military forces. Efficient logistics allow for rapid redeployment and adaptation. Other benefits include the following:

- *Efficiency*: The stakes are incredibly high, making efficiency and reliability absolute necessities in military logistics operations. Enhancing efficiency and achieving cost savings are critical in military logistics. Over the last 20 years, there has been tremendous investment in logistics command and control technology to drive system efficiency. Efficiency through visibility and accuracy is important; it reduces the requirement for physical assets.
- *Maintenance*: This refers to the upkeep of non-consumable materiel and equipment, allowing forces to continue using these items at their original level of capacity and efficiency and for their intended purpose. Maintenance includes all actions to retain materiel and equipment or restore it to a specified condition.

CHALLENGES

The challenges of military logistics are unique. Logistics is an enabler of military operations, not an end in itself. Poor logistics can result in defeat, but even the best logistics cannot guarantee victory. The biggest challenge for all logistics processes is to provide services according to the 7R formula: right time, right product, right quantity, right condition,

right place, right customer, and right price [8]. Other challenges include [8,13,14]:

- *Safety:* Safety is always the priority concern. We have safety processes for any environment or operating condition. The advanced tracking capabilities of RFID technology create a robust security framework that prevents counterfeiting and unauthorized access.
- *Collaboration:* Success in the industry has been driven by the vital collaboration between tier one manufacturers and supplier, as part of the design and testing process. DARPA is looking for potential collaboration with expertise in leading-edge logistics information systems and analysis.
- *Complexity:* There is the complexity of dealing with both old and new technologies in a single logistics enterprise. Logistics is a difficult undertaking for any large organization and the unique demands of military operations add even more difficulties. To remain a vital contributor to military success, logistics must adapt continuously so that it bridges old systems and capabilities while embracing new technologies and concepts. The development of integrated, agile, technologically advanced, and effective logistics systems that drive efficiencies into every corner of the military is increasingly essential in today's dynamic, fast-paced, and ever-changing national security environment
- *Skill Shortage:* There are the challenges of reduction of skilled manpower in the active and reserve forces, the increased difficulty of retaining seasoned military personnel, and a decreasing number of civilian and contractor artisans in the logistics workforce, and the need for modernizing the logistics force.
- *Supply Readiness:* This is another area of concern. Within logistics, the supply function is critical to equipment readiness. Supply readiness is the ability to have the right types and amount of equipment available for a ground unit, a ship, or an aviation unit. Military units cannot perform their mission without the equipment needed to do so. Availability and delivery of parts and spare components, maintenance capability and the capacity to surge increased maintenance volume on short notice, the ability to contract additional support when necessary—all of these logistical elements are essential to military effectiveness. Without those critical elements of materiel readiness, we lose our strategic advantage.
- *Logistic Training*: Proper training in logistics is crucial to successful operations. Current operational logistics training includes abundant supply that is usually within close proximity to warfighters and is provided with little regard to time, distance, priorities, repair, or limitations. Perhaps the most important element missing in training logistics is the consequences of loss. The current army training structure focuses on preparing the combat arms branches for conflict anywhere in the world. However, they fail to stress logistics infrastructure or to teach vital lessons in resource management and expectations.
- *Water:* One of the toughest problems to solve is that of getting water to troops in remote locations. As a general rule, a soldier can survive without water for only about three days. Water has been key in a number of military operations throughout history.
- *Ammunition:* Ammunition is an obvious necessity for soldiers everywhere, and its weight has always been an issue. Not only does ammunition's weight make it more difficult to get to remote areas, but also for individual soldiers to carry enough ammo into combat. Manufacturers are developing ways to lighten ammunition by getting rid of the heavy brass casings that have been standard for decades. Figure 6 shows US Marines receiving ammunition [15].

FUTURE OF MILITARY LOGISTICS

Nobody can be certain what weapons and tactics will prove decisive against 21st-century adversaries on future battlefields. What is undisputable is the US must first be able to deploy forces to those potential battlefields, and then sustain those forces once they are there. Investment in distribution capacity and capability is money well spent regardless of the specifics of future theaters or threats [16].

The future of military logistics is being transformed by RFID technology, integrating with IoT, AI, quantum computing, and blockchain to create intelligent, secure, and automated supply chains. Future logistics command and control systems can ensure agility by operating despite an enemy's efforts to disrupt communications through cyber and electronic warfare. The use of unmanned platforms will be critical to the future of agile logistics.

CONCLUSION

Logistics has always mattered in warfare. It is critical to success on the battlefield. It is the "potential energy" for war, campaigns, and combat. Military logistics concerns all processes and systems involved in generating, transporting, and redeploying or reallocating materiel and personnel. It is a central

component of national power and potential national power, which are distinct from military force.

Military logistics have long served as a priority in the Alliance, both in support of NATO's Military Instrument of Power, and as a standalone capability for member nations. While the United States enjoys many long-standing alliances, relationships have not always been as strong or as coordinated as they could be. More information on military logistics is available from the books in [17-25] and the following related magazines:

- Military Review
- Technology

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Figure 1 US Forces [2].

Figure 2 US Coast Guard [3].

Figure 3 Chinese army [5].

Figure 4 Military logistics [7].

Figure 5 A typical military logistics [9].

Figure 6 US Marines receiving ammunition [15].