

Juhász, Oszvald Viktor¹

THE CONCEPTUAL INTERPRETATION OF LOGISTIC CAPABILITY IN MILITARY AIR FORCES

A KATONAI LÉGIERŐK LOGISZTIKAI KÉPESSÉGÉNEK KONCEPCIONÁLIS ÉRTELMEZÉSE

[HTTPS://DOI.ORG/10.30583/2025-3-4-136](https://doi.org/10.30583/2025-3-4-136)

Abstract

This article presents a conceptual framework for air force logistics capability, defined as the integrated, flexible capacity to align logistics resources and performance processes to sustain capability and availability. Drawing on systems theory and the evolution of military logistics, it identifies two interdependent dimensions: logistic resources and performance processes. This framework provides a foundational methodology for quantitative assessment and enhancement of air force logistic capabilities.

Keywords: military logistics, logistic capability, air force operations, logistic resources and performance, operational impact

Absztrakt

Ez a cikk a légierő logisztikai képességének elvi keretrendszerét mutatja be, amelyet integrált és adaptív képességként definiálnak a logisztikai erőforrások és teljesítményi folyamatok összehangolásakor a fenntartott képesség és a rendelkezésre állás érdekében. A rendszerelméletre és a katonai logisztika fejlődésére építve azonosít két egymástól kölcsönösen függő dimenziót: logisztikai erőforrásokat és végrehajtási teljesítményi folyamatokat. Ez a keretrendszer alapvető módszert biztosít a légierő képességeinek mennyiségi értékeléséhez és fejlesztéséhez.

¹ Juhász, Oszvald Miklós, lieutenant colonel, HDF Medical Center, University of Public Service Doctoral School of Military Engineering PhD student, ORCID: <https://orcid.org/0009-0001-5595-1925>

Kulcsszavak: katonai logisztika, logisztikai képesség, légierős műveletek, logisztikai erőforrás és teljesítmény, műveleti kihatás

Introduction

This research article examines the concept of "logistic capability" within air forces, a critical yet often overlooked determinant of operational success. Moving beyond general definitions, the study provides a precise, academically based interpretation of logistic capability, defining it as the synergistic integration of available resources and their measurable performance in sustaining air operations. By offering a comprehensive analysis of these air force-specific elements, the study provides a nuanced understanding of how robust logistics capabilities improve mission effectiveness and sustain air superiority.

The following article outlines a quantitative methodology for assessing logistic capability and analyzes strategies to enhance and sustain its maintenance.

1. Logistics in definitions

When asked, ordinary people would define logistics something like this: "Logistics is the management of the flow of goods and other resources between the point of origin and the point of consumption - to meet the requirements of customers or corporations." Simply put, logistics is the process of transferring goods from one point to another. A somewhat more professional definition would also include the flow of "information", since in modern society, where devices are everywhere, tracking the flow of data is vital to the efficient management of resources.

This perception is widely accepted, as logistics is often falsely viewed by simply declaring it as a supply chain enabler: "Transport logistics in a supply chain is usually an intermediary that facilitates the physical flow of goods from a point of origin, i.e., shipper, to a point of destination, i.e., consignee. Firms in transport logistics perform the physical distribution function to move goods from one place to another,

and the business process spans organizational boundaries, encompassing shippers and consignees."²

However, we need to understand that logistics is not just simply about "moving" or "transporting" resources; it is much more.

As this article focuses on military logistics, we need to consider how the military defines logistics. The most comprehensive and most widely accepted definition of logistics is as follows ³:

"The science of planning and carrying out the movement and maintenance of forces. In its most comprehensive sense, the aspects of military operations which deal with:

- design and development, acquisition, storage, transport, distribution, maintenance, evacuation and disposition of materiel⁴;
- transport of personnel;
- acquisition or construction, maintenance, operation and disposition of facilities;
- acquisition or furnishing of services; and
- medical and health service support."

The above definition of logistics is accepted unanimously in NATO military forces, including the Hungarian Defence Forces, and applied at the doctrinal⁵ level. Still, it handles logistics at the functional level, dissecting it into functional areas.

It is worth noting that the NATO Standardization Office released the new AJP-4⁶ in August 2025, which does not include the above-quoted definition. The new doctrine, besides adopting a new title and introducing a definition of "sustainment" that encompasses logistics, also

² Kee-hung Lai et al., "Measures for Evaluating Supply Chain Performance in Transport Logistics," *Transportation Research Part E: Logistics and Transportation Review* 38, no. 6 (2002): 439–56, [https://doi.org/10.1016/S1366-5545\(02\)00019-4](https://doi.org/10.1016/S1366-5545(02)00019-4).

³ "AJP-4, Allied Joint Doctrine for Logistics (Edition B)," NATO Standardization Office, 2018.

⁴ Materiel: equipment in its widest sense including vehicles, weapons, ammunition, fuel, etc.

⁵ "Magyar Honvédség Összhaderőnemi Logisztikai Támogatás Doktrína (3. kiadás)," Budapest: HVK Logisztikai Csoportfőnökség, 2015.

⁶ "AJP-4, Allied Joint Doctrine for Sustainment of Operations (Edition C)," NATO Standardization Office, 2025.

establishes a new concept for supporting military operations; thus, its analysis warrants a separate article and further research.

2. Logistics – as defined after in-depth research

Petrus Johannes Pretorius of the University of Pretoria, in his doctoral thesis titled "A generic approach to integrated logistic support for whole-life whole-systems,"⁷ collected the different definitions for logistics, as defined throughout history. As he analyzed the various approaches to logistics in history and the other areas of economy, Pretorius summarized the findings as follows: "... it seems as if logistics can be categorized in at least two dimensions, namely those logistics activities that relate to the military and military operations, and those logistics activities relating to movement of material from point of origin to point of consumption to ensure that proper business can be conducted". In his doctoral thesis, Pretorius identified that logistics should be examined through a systems and lifecycle approach (dynamic complexity) rather than a functional approach (detail complexity).

This approach is what provides the key to understanding logistics. In the following article, I will analyze and summarize Pretorius' findings.

Logistics is a multifaceted discipline best understood through a whole-life, whole-system overview, as advanced by Pretorius' comprehensive thesis. This approach responds to the entrenched functional fragmentation and conflicting definitions reflected in academic and industry practice, offering an empirically validated, model-based perspective essential to practitioners and scholars seeking to optimize system success.

Pretorius' thesis establishes that logistics should be navigated not as isolated functions or domains but as an integrated support system embedded within the broader context of artificial systems. Fragmentation — where logistics is subdivided into sub-areas like marketing, military, and engineering — leads to sub-optimization and failure to meet overarching system goals.

⁷ Petrus Johannes Pretorius, A Generic Approach to Integrated Logistic Support for Whole-Life Whole-Systems, 2002. PhD thesis

His roadmap for logistics examination mandates:

- Systems consideration over multidisciplinary patchworks — emphasizing synthesis, interdependency, and causality.
- Lifecycle consideration — from conceptualization, development, commissioning, operation, maintenance, to disposal.
- Recognition that ability, availability, and affordability are measures of system success dependent on logistics. (These are in harmony with primary NATO logistic principles³)

Systems concept enables navigation of dynamic complexity, as cause and effect are separated in time and space, and where superficial detail complexity obscures high-impact leverage points. For example, seemingly minor early design choices can profoundly affect operational success, support costs, and maintainability decades later. Thus, logistics must be designed and managed iteratively, integrating managerial and technical activities continuously across the lifecycle. These findings are also key considerations in military logistics planning.

Pretorius provides exhaustive conceptual clarity by formalizing key logistics foundations:

- The central definition, adapted from Blanchard⁸, describes Integrated Logistic Support as a "disciplined, unified and iterative approach to management and technical activities" that ensures support considerations are woven throughout a system's lifecycle to consistently achieve readiness objectives, safety, ability, availability, and affordability.
- Logistics is not just movement or supply, but a technical and managerial subsystem tasked with sustaining all other subsystems. This support subsystem must cater to design, acquisition, operation, maintenance, and ultimately, system retirement. (These can be found in the NATO logistics definition, as quoted above.
- Systems undergo cradle-to-grave cycles. Logistics activities — including support analysis, resource identification, design influencing, and maintenance systems — must align with each phase, requiring distinct expertise and process integration.
- Logistics encompasses both technical tasks (e.g., support concept development, support resource identification and design,

⁸ Benjamin S. Blanchard, *System Engineering Management*, 3. ed (Wiley, 2004).

maintenance planning) and managerial objectives (e.g., policy development, cost control, scheduling, performance measurement); both must be in unison for optimal system outcomes.

In both military and business contexts, fragmented or cost-centric definitions risk undermining systemic effectiveness. I will return to this finding later in my publication. Still, it is a key aspect of military logistics: the military has never been, and will never be, a profit-oriented organization. From an economic point of view, it is a non-profit (almost cost-insensitive) organization, and its functions shall never be fragmented, since this will have a profound impact on mission success.

Logistics is not an end in itself, nor is it merely an agent for cost reduction — rather, it is an indispensable element in achieving strategic and operational goals, customer value, and mission success. For products and organizations, logistics underpins the value chain, supports strategy, and determines lifecycle outcomes. Its activities range from raw material procurement, warehousing, and distribution to technical documentation, failure analysis, training, and resource planning.

Pretorius emphasizes that logistics should not be optimized solely for resource utilization, lest such actions become counterintuitive — to optimize part of the system at the expense of the whole risks undermining overall performance. This finding is also important in military implications, which I will cover later.

Pretorius identifies and critiques the dominant tendency to view logistics as a sum of standalone functional areas, demonstrating with detailed evidence and models that fragmented views lead to broken solutions, cross-domain inefficiencies, and strategic misalignment.

To summarize, Pretorius' thesis ⁷ establishes that only a holistic, integrated approach to logistics can yield optimal system performance across the dimensions of ability, availability, and affordability. Logistics is inherently systemic, transcending narrowly defined functions and integrating all support elements over the entire organizational or product lifecycle. Through technical and managerial integration, proactive design influencing, thorough supportability analysis, and rigorous operational planning, logistics fulfills its true purpose: enabling systems to meet goals reliably, sustainably, and affordably. Ignoring integrated logistic support in favour of fragmented, functionally siloed logistics risks undermining system success, escalating costs, and breeding inefficiency.

Despite my findings, that Pretorius' models have just some, above highlighted relevance to military logistics, since they are very useful and have great implications for firms with robust business models, his research provides a strong theoretical and practical foundation for both academic and practical users, calling for broader adoption of systems approaches and deeper exploration of detail and dynamic complexity in future studies. For this reason, I applied his findings in my further studies of logistic capabilities.

3. Military logistics — a unique environment

Since Pretorius's work focused solely on civilian logistics, I continued my studies in military logistics research. The article "Evolution of Military Logistics" by Aldemar Serrano et al.⁹ presents an extensive historical review and analysis of military logistics, emphasizing how this concept has evolved and should now be viewed differently in more dynamic terms.

They highlighted that military logistics has been a critical factor since ancient times, evolving alongside warfare and technology. The article identifies 21 definitions of military logistics spanning from 1792 to 2019, illustrating how its meaning and scope have changed. Traditionally, military logistics has focused on supplying basic needs such as lodging, clothing, and food to soldiers, but this view has been too narrow, given the complexities of modern warfare.

It is described as evolving in both art (qualitative, creative, situational) and science (quantitative, systematic, technological), highlighting the need to integrate these dimensions in contemporary logistics thinking.

They found that each military evolution, marked by changes in technology, tactics, and strategy, has triggered a corresponding progress in military logistics (Military Logistics Revolution, MLR). This relationship shows that logistics is essential not only to support combat capabilities but also to enable new forms of military operations. The logistic support needs to adapt rapidly to innovations such as mechanized transport, telecommunications, and digital command and control.

⁹ Aldemar Serrano et al., "Evolution of Military Logistics," *Logistics* 7, no. 2 (2023): 22, <https://doi.org/10.3390/logistics7020022>.

Their article stresses that logistics must evolve from a mere support function to a strategically integrated element that anticipates and proactively meets the needs of military forces. A key trend identified is the adoption of focused logistics that leverages advanced technologies to deliver supplies, personnel, and equipment in real time, with precision and efficiency.

This concept supports agile, networked, and distributed military operations, including modern warfare domains like cyber and space. Thus, as highlighted in the previous chapter, the logistics system becomes a dynamic enabler of operational success rather than just a reactive supply chain.

The authors propose a new conceptual framing for military logistics as: "The science that continuously studies, plans, manages, and systematically executes the process of timely supply of the necessary resources for the operation of armed forces, in the domains of war, using the technologies and means available to dynamically contribute to the development of the operation and the maneuverability of the units."

This definition integrates the historical dual nature of logistics (art and science) with modern demands for responsiveness, technological integration, and operational relevance. While military logistics shares some principles with business logistics, it differs significantly due to the complex, uncertain, high-stakes context of war. Military logistics must prioritize mission success, survivability, and rapid adaptability over cost-efficiency or profit motives.

In summary, the article argues that military logistics should be viewed not just as a traditional supply function, but as a transformational, integrated science and art closely linked to military and technological evolutions. It evolves through advances that reshape warfare, adopting technological innovations and operational concepts like focused logistics, contested logistics, and multi-domain operations.

The proactive, agile, network-enabled logistics system proposed enables armed forces to operate effectively in complex, rapidly changing conflict environments, meeting their needs before demands arise. This perspective marks a significant shift in logistics thinking — from supporting forces reactively to empowering and shaping military capabilities strategically with advanced technologies and adaptive processes.

4. Logistic capability — a general introduction

As my doctoral studies focus on the provision and enhancement of air force logistic capabilities, we first need to define what "logistic capability" is and then refine it to "air force" logistic capability.

Both previously analyzed works had these key features in common:

- Logistics should be viewed as a complex system and should not be dissected,
- logistics starts from planning and ends with disposal, and last, but most importantly
- Logistics is all integrated into the main operation and has a significant impact on the outcome.

Because of these, logistics is an all-around asset, the capability of which determines the operation of the complete system – in military terms, this is what governs mission success.

4.1. The Concept of Logistic Capability

The Hungarian Military Science Lexicon¹⁰ defines logistic capability as follows: "the availability of civil and military force, equipment, or opportunities for accomplishing material, technical, medical, transport (delivery), and accommodation tasks and objectives.

Logistic capability is an integrative concept, encompassing the combat readiness of individual logistic organizations. Its most important components (factors) include: the completeness of personnel, armament, and technical assets of the military logistic organization; indicators characterizing the supply of material-technical assets; the standard of combat training; the moral, disciplinary, and combat status of the personnel; and the status of the logistic command. Additionally, crucial elements are the organization's ability to achieve operational readiness, its survivability, and the tactical and maneuvering capabilities of its technical assets. Due to the specifics of logistic support, this concept also includes the collective transport, storage, service-providing, and receiving capacities of logistic units and subunits. The structure and

¹⁰ Zoltán Krajnc et al., *Hadtudományi Lexikon*, 1st ed., (Ludovika Egyetemi Kiadó, 2019).

capability of each logistic organization adapts to the basic purpose and operational requirements of the supported unit or subunit."¹¹

However, as I have outlined in my previous publication¹², logistic capability can also be defined as the integrated and dynamic interaction between logistic resources and logistic performance, designed and managed to ensure the sustained ability, availability, and affordability of a system or organization to achieve its goals. This definition aligns conceptually with Pretorius' systems-based view of logistics, which emphasizes that logistics is a support subsystem within a broader system, integrating managerial and technical activities across a system's life cycle to optimize the system's ability, availability, and affordability. As Pretorius argues, logistics decisions must be based on systemic and lifecycle-dependency, not as isolated operational actions. Similarly, logistic capability should be viewed as a systemic property, arising from the interaction between resource sufficiency and the performance of processes that transform those resources into operational readiness.

While Pretorius focuses on integrated logistic support (ILS) applied to the creation and sustainment of manufactured systems, the concept of logistic capability extends these principles to assess and develop logistic readiness at the organizational level — particularly relevant within military and air force environments. In this context, logistics capability becomes the measure of how effectively an organization transforms logistic resources into operational outcomes that directly contribute to mission success.

We also need to highlight that studies have proven that logistics capability affects the performance of the whole system.¹³

4.2. The Dual Structure of Logistic Capability: Resources and Performance

Pretorius proposes that system success depends on ability, availability, and affordability – all of which are influenced by the integration of logistics functions into system design, management, and operation.

¹¹ Translated by the author of this article

¹² Oszvald Viktor Juhász, "A KC-390 Rendszerbe Állításával Megjelenő Új Logisztikai Képességek," *Katonai Logisztika* 33, nos. 1–2 (2025): 203–26, <https://doi.org/10.30583/2025-1-2-203>.

¹³ Andrea GELEI, "Túl a kritikus ponton - logisztikai képességek Magyarországon," *Vezetéstudomány - Budapest Management Review*, no. 42.1 special edition (2011): 64–71.

Translating that principle into a capability framework yields two interdependent dimensions: resources and performance.

4.2.1. Logistic Resources

Resources represent the potential capability — the means and elements that enable logistic activities to occur. Pretorius places strong emphasis on resource identification and support system design in logistics engineering, highlighting that true system efficiency depends on the correct specification and integration of required support resources. In the context of logistic capability, resources can thus be grouped into the following interrelated sub-areas:

Procedural (Doctrinal) Resources:

These encompass doctrines, policies, standard operating procedures (SOPs), and regulations that define how logistics is planned and executed within the given organization. They constitute the conceptual foundation that enables standardized logistic behavior across the organization. Without clear doctrines and procedures, resources and personnel operate chaotically, leading to sub-optimization — the very condition Pretorius warns against when logistics functions become fragmented. Well-defined procedures ensure systemic coherence, serving as the framework within which performance can occur effectively.

Human Resources:

Personnel are a critical element in transforming logistics plans into operational outcomes. Pretorius emphasizes that system success ultimately depends on the system's human interfaces, including operators, maintainers, and logisticians. Trained, adequately staffed, and competent human resources provide the system's operational flexibility, creativity, and resilience: inadequate human resourcing or poor skill alignment results in bottlenecks that undermine system availability and performance.

Materiel and Infrastructure Resources:

These include all physical assets such as equipment, vehicles, aircraft, weapon systems, information systems, maintenance facilities, warehouses, fueling points, and transport networks. Pretorius repeatedly observes that systems are limited by their inherent physical design characteristics; logistics engineering must therefore ensure early design integration to maintain capability and

affordability throughout the life cycle. In terms of capability, this means ensuring that infrastructure and materiel systems are properly designed, procured, and maintained to support both routine and surge operations.

Information Resources:

Pretorius highlights information flow and feedback as prerequisites to sustain integrated system design and operation. In the context of logistics capability, information resources include databases, IT networks, logistics information systems, and knowledge management structures that enable situational awareness, decision-making, and the optimization of support processes.

Financial Resources:

Capability limitation depends on affordability, which Pretorius describes as the lifecycle cost consciousness of systems engineering. Financial resources fund the creation and sustainment of logistic capacity. Their adequacy determines continuity of operations, while their mismanagement can immobilize even the most technically proficient system.

4.2.2. Logistic Performance

Performance represents the realized capability — how well available resources are coordinated through processes, training, and behavior. In Pretorius' systems terminology, performance corresponds to how well the "support system" converts design and operational inputs into measurable outcomes along the dimensions of ability, availability, and affordability. Key sub-areas of logistic performance may include:

Procedural Implementation:

The degree to which established doctrines and standards are effectively applied in practice. Pretorius' model of feedback and iteration emphasizes that procedures must not only exist but also be continuously tested, refined, and integrated into the lifecycle support system. Implementation reflects discipline, leadership, and organizational culture — factors crucial to maintaining uniform logistic performance.

Training and Competence Development:

Training transforms potential into effective performance. Pretorius acknowledges that design features and logistic infrastructure are worthless unless operators are trained to use them effectively. Logistics capability, therefore, depends on systematic training programs, competency maintenance, and doctrine-based learning that adapt alongside technological and environmental change.

Individual and Collective Task Execution:

The way individuals and teams perform assigned tasks within logistic subsystems determines operational readiness. Through Pretorius' logic of "ability and maintainability by design," poor task execution not only increases downtime and costs but also diminishes the total system's effectiveness.

System Adaptability and Responsiveness:

An additional performance element, particularly emphasized in dynamic military contexts, is the ability of logistics systems to adapt to changing conditions. Pretorius' concept of lifecycle iteration supports this — he argues that systems must adapt operationally as they mature. A capable logistics system must similarly sustain responsiveness under changing operational demands.

5. Logistic Capability in Air Force Organizations

5.1. Introduction

Logistic capability is a strategic determinant of operational success, especially in air forces, where readiness, adaptability, and mission accomplishment hinge on the organization's ability to align resources and performance across complex systems and dynamic operational demands. Throughout military history, whenever the importance of logistics was overlooked, failure was the inevitable result. Rather than treating logistics as a sum of isolated activities, contemporary systems thinking positions consider logistic capability as a systemic property that emerges from the deliberate integration of resource sufficiency with high-performance processes. This view demands continuous evaluation and improvement, ensuring that both the components and their interactions remain optimal and responsive throughout the system's life cycle.

Logistic support for real military operations has changed; military operations and logistic support have had a mutual effect on each other, and not all doctrinal-level cornerstones have been adapted to real-life scenarios.¹⁴ Also, military logistics is, in many respects, very different from civilian logistics, but they can benefit from each other^{15, 16, 17} All these considerations make the study of logistics principles and their cornerstones more important.

5.2. Unique properties and requirements of the Air Force

The Air Force's logistics system has unique characteristics that fundamentally distinguish it from those of other military branches, such as the Army, Navy, or Marines. These distinctive traits stem primarily from the Air Force's operational domain, which is inherently three-dimensional, rapid, and technology-intensive.

Air Force logistics must accommodate the demands of aviation, which requires the continuous and precise supply of highly specialized support services, including fuel, munitions, spare parts, and maintenance for complex aircraft and related avionics equipment. Unlike ground forces, where logistical nodes may be more static, Air Force logistics face the challenge of supporting widely dispersed, dynamically relocating air bases and forward operating locations, often in austere or contested environments, especially for helicopters and tactical transport aircraft.

The operational tempo and range of air operations impose stringent requirements on the speed, flexibility, and reliability of the logistics supply chain. Operational tempo demands robust global reach capabilities that integrate strategic airlift, in-flight refueling, and rapid deployment of repair and support teams to maintain aircraft availability and mission readiness. The concepts of just-in-time and anticipatory logistics are particularly critical in Air Force logistics to minimize aircraft downtime and optimize mission capability. Additionally, the high value and

¹⁴ Nyitrai Mihály, "A NATO műveleti logisztikai támogatás vizsgálata többszemponútú döntéselőkészítési módszerrel" (PhD, Nemzeti Közsolgálati Egyetem, 2023), <https://doi.org/10.17625/NKE.2023.027>.

¹⁵ *litary Sciences*, ed. Anders McD Sookermany (Springer International Publishing, 2021), https://doi.org/10.1007/978-3-030-02866-4_71-1.

¹⁶ Steve John Simon, "The Art of Military Logistics," *Communications of the ACM* 44, no. 6 (2001): 62–66, <https://doi.org/10.1145/376134.376167>.

¹⁷ Ilari Valtonen et al., "Capability Development in Hybrid Organizations: Enhancing Military Logistics with Additive Manufacturing," *Progress in Additive Manufacturing* 7, no. 5 (2022): 1037–52, <https://doi.org/10.1007/s40964-022-00280-z>.

technological complexity of aviation platforms necessitate precision in handling, transportation, and storage to preserve operational capability.

Furthermore, Air Force logistics integrates advanced information technologies and network-centric systems to provide real-time visibility, predictive maintenance, and automated inventory management. These elements support rapid decision-making and synchronize logistics with operational planning and execution.

The critical dependence on fuel — accompanied by very stringent quality control — as a principal consumable distinguishes Air Force logistics, emphasizing the establishment of secure, reliable fuel supply lines across multiple domains, including land, sea, and air.

In addition, the operational environment demands exceptional reliability, stringent safety standards, and persistent readiness. While general systems engineering principles remain foundational, military air force logistics require distinct amplifications due to unique operational and safety demands:

- Real-Time Operations: The necessity for logistics to function seamlessly under combat conditions compresses feedback cycles and requires rapid, flexible adaptation to changing conditions.
- Rigorous Safety and Compliance: Aviation-centric systems must adhere to strict standards, necessitating robust procedural discipline and built-in system redundancies.
- Unpredictable Demand Patterns: Air Force logistics face highly variable demands. Systems must be flexible, responsive, and maintain buffer capacities for contingency operations.
- Direct Mission Support: Successful air logistics is judged by mission effectiveness, emphasizing operational capability and availability over cost containment in critical phases.

These requirements necessitate specialized system modelling, continuous data-driven adaptation, and forward-looking resource planning.

In summary, military air force logistic capability is best understood as the emergent result of the synchronized interplay between resource allocation and high-performance processes, specialized for air power generation and sustainment. True capability is not merely the presence of resources, nor the pursuit of efficiency in isolation, but the adaptive,

responsive, and resilient transformation of those resources into mission-ready outcomes. Therefore, logistic capability in an Air Force also consists of two intimately connected dimensions: resources and performance. These domains, while analytically separable, are interdependent — performance depending on how well available resources are deployed, managed, and adapted to operational needs.

Accordingly, sub-areas of resources and performance are refined as follows:

5.2.1. Logistic Resources

The resource base defines the latent potential of a military air force's logistic system. Resources can be organized into distinct but related categories:

Procedural (Doctrinal) Resources: Encompassing established doctrines, policies, plans, SOPs, and regulations, these underpin standardized operational behaviour and provide direction, accountability, and transparency. Robust doctrinal resources synchronize activities, reduce ambiguity, and minimize the likelihood of delays and missteps. These doctrines provide the basis for proper training, uniformity, and mutual understanding, and also serve as a guideline and compass for robust command and control: Air Force doctrine structures roles, responsibilities, inter-service coordination, and international cooperation. Standardized doctrine supports high-tempo action and unified direction, directly impacting mission precision and joint force interoperability.

Human Resources: Personnel form the backbone of logistic capability, spanning planners, maintainers, technicians, supply managers, and support teams. The effectiveness of human resources depends on recruitment, training, competency development, and motivation. Skilled personnel are critical for sustaining maintenance quality, operational tempo, and rapid force regeneration. Within military organizations, this is most commonly guided by the table of organization and equipment¹⁸.

A table of organization (often called a Table of Organization and Equipment, or TOE/TO&E) is an official military document that prescribes the structure, staffing, and equipment of a military unit. It details the number and types of personnel, their duties, and the major items

¹⁸ *Wikipedia*, "Table of organization and equipment," September 10, 2025, https://en.wikipedia.org/w/index.php?title=Table_of_organization_and_equipment&oldid=1310621183.

of equipment authorized for the unit. The table serves as a blueprint for a unit's organization, outlining its mission, capabilities, and the resources required to fulfill its operational role.

Key points about a table of organization:

- It specifies the unit's organizational structure, including command hierarchy and sub-units.
- It lists the positions, ranks, and duties of all personnel assigned to the unit.
- It details the types and quantities of equipment and vehicles the unit is authorized to possess.
- It is used for planning, operational readiness, and deployment, ensuring that units are properly staffed and equipped for their missions.
- Variations exist, such as the Modified Table of Organization and Equipment (MTOE), which adapts the standard structure to specific unit needs or missions.

Materiel and Infrastructure: Consisting of aircraft, vehicles, IT systems, maintenance assets, bases, hangars, fuel depots, key facilities and ground support equipment, this category ensures the system's physical capacity to execute logistic functions. Infrastructure investments must anticipate both routine and surge demands, with emphasis on resilience and adaptability. Bases, maintenance depots, runways, mobile support units, and storage facilities provide the backbone for both routine and contingency logistics. Based on investments in resilient, modular, and technologically advanced infrastructure, rapid deployment and theatre-level operations are supported. Major end items, weapon systems and sometimes specific infrastructural elements are included in the TOEs.

Information Resources: Modern logistics relies on secure, adaptable information systems, databases, analytical platforms, and knowledge management tools. These support decision-making, enable real-time visibility, and ensure the seamless coordination of supply, transportation, and maintenance activities. Advanced logistics analytics, predictive maintenance tools, and secure communication platforms synchronize logistic activities with operational command, reduce uncertainty, and enable strategic agility.

Financial Resources: Sustainable capacity depends on strategic budgeting, efficient contracting, and resource prioritization. Effective

allocation and management of financial resources safeguard continuity and flexibility, supporting operations across all phases. Multiyear budgeting, flexible contracting options through dynamic procurement, and rapid resource-tracking tools enable adaptation to changing mission needs and support surge capabilities.

The sufficiency and design of these resources directly enable operational achievement, supporting everything from rapid aircraft turnaround to efficient mission sustainment and long-term force scalability. Each resource category directly affects the efficiency and effectiveness of mission accomplishment. Poorly defined doctrine, insufficient training, or inadequate infrastructure will hinder operational readiness and increase risk during high-intensity operations.

5.2.2. Logistic Performance

Procedural Implementation: The application of doctrine and SOPs during logistic operations. High compliance, iterative validation, and regular refinement elevate reliability, reduce error frequency, and align tactical execution with strategic intent. To achieve uniformity, common understanding, and robust command and control, the implementation of well-defined doctrines and procedures is a key asset to mission success. Exact execution of maintenance protocols, supply processes, and operational checks ensures that logistic failures do not become bottlenecks for air missions. Rigid and ruthless adherence to standards and procedures distinguishes the military from any other branch of society.

Command, control, and communication (C3): The exercise of authority and direction in logistics ensures coordination across all functions. Command and control facilitate informed, timely decisions, integration between operational and logistic staffs, prioritization of resources, and the orchestration of complex support during both routine and contingency operations. Effective command and control dynamically adjust logistics operations to the tactical and strategic environment, optimizing support for mission objectives. The seamless flow of information between logistics and operational command ensures resources are matched to mission requirements, supports rapid course correction, and minimizes delay.

Training, competence and task execution: Structured training routines, recurrent qualification exercises, and scenario-based simulations prepare personnel to operate advanced systems and respond to evolving threats or operational demands. With proper training, effective performance at

both the individual and team levels translates into precise, efficient maintenance and supply actions. Responsibility, collaboration, and faultless execution are paramount for sustaining aircraft readiness and supporting sortie rates. It is also crucial to develop and maintain the capability of adaptability and responsiveness, the ability to adjust to new mission profiles, environmental shifts, technological changes, and surge requirements, which underpins logistic readiness and system resilience. Rapid mobilization, reconfiguration, and continuous improvement are hallmarks of a high-performance logistic capability. The continuous professional development ensures personnel mastery of new platforms, rapid troubleshooting, and cross-functional support, enabling teams to recover quickly from failures and adapt to new mission profiles. High standards of individual and team performance — especially in maintenance, supply, and transport — are crucial for achieving sortie rates, maintaining operational tempo, and supporting fast-turn missions.

Personnel specialization: Maintenance teams, supply chain experts, munitions handlers, and transport managers must possess deep technical competency and the ability to operate advanced systems under stress. Human capital development is increasingly vital as technology evolves and operational complexity grows.

Supply system management: This domain covers the planning, procurement, storage, distribution, and tracking of supplies, spare parts, and consumables. Robust supply system management ensures that critical items are available at the right time and place, reduces bottlenecks, manages stock levels efficiently, and responds flexibly to changes in demand. It also applies advanced forecasting, automated inventory systems, and supply chain analytics to anticipate and resolve potential shortages.

Provision of fuel: Providing fuel is a critical performance capability for any air force, underpinning the deployment, reach, and tempo of air operations. Fuel logistics ensure continuous readiness by storing, distributing, and delivering aviation fuel, ground fuel, and specialized liquids such as liquid oxygen. Quality control is paramount: every batch undergoes rigorous sampling, filtration, and contamination checks to guarantee compliance with operational standards before entering the aircraft systems. Fuel operations must function across diverse environments — including main operating bases, austere airfields, offshore refuelling points, and in-flight refuelling platforms — requiring flexibility in both infrastructure and personnel. The sheer volume of fuel needed for sustained sorties demands precision planning, redundancy, and global

coordination: a squadron of jets may require close to 3 million litres of jet fuel within a 30-day period¹⁹. The Petroleum, Oils, and Lubricants (POL) units manage these complex systems, optimizing efficiency and safety under all conditions. Effective fuel provision directly defines sortie generation rates, strategic endurance, and overall mission success.

Maintenance of main weapon systems: The execution of scheduled and unscheduled repairs, inspections, and upgrades to major weapon systems — especially aircraft, vehicles, and ordinance platforms. High-quality maintenance sustains operational availability, prolongs system life, and underpins mission readiness. Maintenance excellence depends on skilled technicians, fault diagnosis, access to technical data, and integration with supply and information systems. Proactive and predictive maintenance strategies reduce downtime, manage lifecycle costs, and support rapid mission turnarounds.

In the air forces of different nations, as outlined in the US Air Force, aircraft maintenance is generally organized into three main levels, each with distinct responsibilities and technical depth²⁰:

- The first level is organizational maintenance, performed by the unit that operates the aircraft or equipment. This level includes routine servicing, inspections, minor repairs, preventive maintenance, and the removal and replacement of easily accessible components. The personnel involved are typically flight-line or squadron maintenance staff, and their focus is on launch and recovery of sorties, daily checks, and quick fixes to keep aircraft mission-ready. Examples of tasks at this level include pre-flight and post-flight inspections (including aircraft turnarounds), tire changes, oil servicing, and sometimes the replacement of line-replaceable units.
- The second level is intermediate-level maintenance, which provides more in-depth maintenance than the organizational level and is performed in specialized back shops or centralized repair facilities. This level covers troubleshooting, repair, and replacement of components that require more time, tools, or expertise than are available at the flight line. It may involve calibration, testing, and repair of

¹⁹ Based on 12 jets, 2 sorties per day, 4 000 liters per jet

²⁰ Thomas E. Reiter, *USAF Aircraft Maintenance Organizational Structure: Where We've Been, Where We Are, What's the Future*: (Defense Technical Information Center, 1988), <https://doi.org/10.21236/ADA202701>.

avionics, hydraulics, and other subsystems. Maintenance specialists with advanced training typically perform these tasks, which support the operational unit by handling repairs that cannot be completed on the flight line but do not require full depot resources. Sometimes personnel with different expertise serve at this level.

- The third level is depot-level maintenance, which is the most comprehensive and technically demanding. It is performed at dedicated depot facilities and involves major overhauls, complete rebuilds, extensive modifications, upgrades, and testing of aircraft, engines, and major assemblies. Highly specialized technicians, often at centralized air logistics complexes or contractor facilities, conduct this work. The focus at this level is on extending the service life of aircraft and equipment, implementing major upgrades, and, when necessary, restoring items to "like new" condition. Examples of depot-level maintenance include complete aircraft overhauls, structural repairs, engine rebuilds, and system upgrades.
- Some air forces have adopted a two-level maintenance concept, consolidating intermediate tasks into either the flight line or depot as technology and logistics systems evolve. However, the three-level model remains common, especially for complex weapon systems and aircraft.

Besides the maintenance of main weapon systems, other, equally significant areas are also maintenance-related, some of which are included in aircraft maintenance in many nations:

Battle damage repair²¹²²: It refers to the essential, often rapid repairs performed in a battle or combat environment to restore damaged or disabled aircraft or equipment to temporary or operational service. The purpose of BDR is to quickly return battle-damaged aircraft to a mission-capable state, enabling continued operational use while minimizing downtime. BDR may involve improvised or expedited repair

²¹ Darrell H Holcomb, *Aircraft Battle Damage Repair for the 90's and Beyond*, Research report AU-ARI-93-4 (USAF, 1994), National Technical Reports Library, <https://apps.dtic.mil/sti/tr/pdf/ADA278635.pdf>.

²² Bruve J. Kaplan and D. Jerry Wallick, "Revision 1—Aircraft Battle Damage Repair (BDR) Analysis Methodology Development Requirements," Logistics Management Institute, McLean, VA, Tech. Rep., November 1, 1994, LMI-JL301RD1, <https://apps.dtic.mil/sti/pdfs/ADA304294.pdf>.

techniques conducted by specially trained maintenance teams at or near the site of damage, sometimes called Aircraft Battle Damage Repair (ABDR). These repairs cover structural damage, system replacements, and patching to critical aircraft components, allowing for one-time or sustained flight operations until full repairs at a depot or maintenance facility can be performed. The Air Force emphasizes BDR as a crucial element in maintaining air capability during conflict, sustaining operational tempo and mission success under adverse and rapidly changing conditions.

Storage and preparation of aircraft weapons²³: Though often questioned, the sole purpose of an aircraft is to deliver the weapons it carries. Aircraft weapons storage and preparation constitute a critical logistic capability within an Air Force, vital to ensuring operational readiness and mission success. This capability encompasses the secure storage, handling, maintenance, and timely preparation of a diverse array of munitions and armaments for deployment. Effective weapons storage involves adherence to safety protocols, environmental controls, and inventory management systems to protect sensitive ordnance from damage and unauthorized access. Preparation includes inspecting, assembling, and configuring weapons systems to meet specific mission requirements. This logistic function supports the rapid armament of combat aircraft and ground systems, ensuring ammunition readiness aligned with operational tempo. The capability depends on trained personnel, dedicated facilities, and automated inventory tracking systems that mitigate risks and optimize resource utilization throughout the weapons lifecycle.

Equipment maintenance^{24,25}: ground support equipment (GSE) and vehicle maintenance capability are vital logistical functions that directly enable aircraft readiness and mission success. This capability includes the maintenance, servicing, and repair of diverse equipment, including hydraulic test stands, ground power units, refuelers, tow tractors, and maintenance platforms, all of which are essential to supporting air

²³ Mohammad J. Marashdeh, *Logistic Support Planning for New Aircraft Weapon Systems*: (Defense Technical Information Center, 1988), <https://doi.org/10.21236/ADA202043>.

²⁴ "AIRCRAFT AND EQUIPMENT MAINTENANCE MANAGEMENT," Department of the Air Force, 0 20, 2023, https://static.e-publishing.af.mil/production/1/af_a4/publication/dafi21-101/dafi21-101.pdf.

²⁵ "Military Aircraft Ground Support Equipment Roles," accessed October 20, 2025, <https://www.governmentprocurement.com/news/military-aircraft-ground-support-equipment>.

operations. Ground support equipment maintenance ensures that these assets are reliable, safe, and available when needed, minimizing downtime and operational disruptions. Dedicated GSE maintenance units provide routine inspections, fault diagnosis, component replacement, and functional testing. Effective GSE maintenance enhances force projection by sustaining seamless aircraft servicing, fueling, and ground operations under dynamic conditions. This integrated maintenance capability is fundamental to maintaining high sortie generation rates and rapid aircraft turnaround in operational theatres.

Performance in these collective domains translates the latent capacity embedded in resources into tangible effects, driving operational availability, responsiveness, and effectiveness. Discipline in command and control, supply system management, and weapon system maintenance ensures that the logistic enterprise directly and efficiently supports military objectives, maximizing readiness for both routine and high-intensity operations.

5.2.3. Interdependence: Resource-Performance Feedback

In advanced logistic systems, capability is validated through the seamless feedback between resources and performance. Pretorius stresses that system effectiveness emerges only through the proper integration of all subsystems; isolated optimization of any single component risks overall degradation. Applying that principle to air force logistic capability, resources form the structural capacity of the logistic system, while performance constitutes its operational realization. The interface between the two — how performance transforms resources into mission outcomes — is the very essence of capability. Doctrinal resources enable standardized performance; human and information resources determine how well procedures and infrastructure are employed; financial and materiel resources set physical boundaries within which performance occurs. Capability emerges when the transformation of resources through procedural, cognitive, and technical action produces demonstrable readiness and mission sustainment outcomes.

6. Definition of air force logistic capability

To summarize my findings above, integrating the analyzed scientific studies, logistic capability in military air force organizations represents a critical strategic enabler that transcends mere resource availability or

isolated functional efficiency. It emerges from the complex and continuous interaction between diverse logistic resources — such as doctrinal frameworks, human capital, materiel and infrastructure, information systems, and financial assets — and their effective deployment through disciplined performance processes including procedural implementation, command and control, training, and supply system management. This dual structure emphasizes that sustained operational success depends not only on resource sufficiency but also on the orchestration of these assets for adaptive and flexible response to evolving mission demands. In dynamic, technology-intensive air operations, logistics capability ensures readiness, responsiveness, and affordability, directly impacting the organization's ability to generate and sustain combat power.

Hence, as a new scientific achievement, I define "air force logistic capability" as follows:

Air force logistic capability is the integrated and adaptive capacity of an air force organization to align and transform its logistic resources and performance processes into sustained ability, availability, and affordability, thereby ensuring continuous mission readiness of aircraft and major weapon systems and the effective generation and sustainment of air combat power across dynamic operational environments.

This definition shall serve as a basis for future studies that aim to evaluate or measure logistic capability and provide a guideline for projects that study the possibilities for the provision and enhancement of logistic capability. The provision and enhancement of logistics capability are what I aim to achieve in my further studies, and I plan to publish the results in follow-up articles.

7. Summary

This study offers a comprehensive conceptualization of logistic capability within military air forces, emphasizing its critical strategic importance to operational success. Moving beyond fragmented functional definitions, it positions logistic capability as an integrated and dynamic interaction between diverse logistic resources—spanning doctrinal, human, materiel, information, and financial domains—and disciplined performance processes including procedural implementation, command and control, training, and supply management. Unique operational

demands of air forces, characterized by rapid, technologically intensive, and distributed missions, necessitate a logistics system tailored to ensure the sustained availability, capability, and affordability of critical assets. The findings highlight that true logistics capability is realized through continuous, adaptive orchestration of resources and performance to maintain mission readiness and sustain combat power in dynamic environments. This systemic approach not only advances academic understanding but also provides a practical framework for evaluating, provisioning, and enhancing air force logistics capabilities to meet future operational challenges effectively. This foundational definition and framework will guide further research and methodological development aimed at quantitative assessment and strategic improvement of military air logistics.

Resources:

“AIRCRAFT AND EQUIPMENT MAINTENANCE MANAGEMENT.” Department of the Air Force, 0 20, 2023. https://static.e-publishing.af.mil/production/1/af_a4/publication/dafi21-101/dafi21-101.pdf.

“AJP-4, Allied Joint Doctrine for Logistics (Edition B).” NATO Standardization Office, 2018.

“AJP-4, Allied Joint Doctrine for Sustainment of Operations (Edition C).” NATO Standardization Office, 2025.

Andrea GELEI. “Túl a kritikus ponton - logisztikai képességek Magyarországon.” *Vezetéstudomány - Budapest Management Review*, no. 42.1 különszám (2011): 64–71.

Blanchard, Benjamin S. *System Engineering Management*. 3. ed. Wiley, 2004.

Holcomb, Darrell H. *Aircraft Battle Damage Repair for the 90's and Beyond*. Research Report AU-ARI-93-4. USAF, 1994. National Technical Reports Library. <https://apps.dtic.mil/sti/tr/pdf/ADA278635.pdf>.

J. Kaplan, Bruve, and D. Jerry Wallick. “Revision 1—Aircraft Battle Damage Repair (BDR) Analysis Methodology Development Requirements.” Logistics Management Institute, McLean, VA, Tech. Rep., November 1, 1994. LMI-JL301RD1. <https://apps.dtic.mil/sti/pdfs/ADA304294.pdf>.

Juhász, Oszvald Viktor. “A KC-390 Rendszerbe Állításával Megjelenő Új Logisztikai Képességek.” *Katonai Logisztika* 33, nos. 1–2 (2025): 203–26. <https://doi.org/10.30583/2025-1-2-203>.

Krajnc, Zoltán, Balázs Forgács, István Göcze, József Szabó, and Miklós Szabó. *Hadtudományi Lexikon*. 1st ed. Ludovika Egyetemi Kiadó, 2019.

Lai, Kee-hung, E.W.T Ngai, and T.C.E Cheng. “Measures for Evaluating Supply Chain Performance in Transport Logistics.” *Transportation Research Part E: Logistics and Transportation Review* 38, no. 6 (2002): 439–56. [https://doi.org/10.1016/S1366-5545\(02\)00019-4](https://doi.org/10.1016/S1366-5545(02)00019-4).

“Magyar Honvédség Összhaderőnemi Logisztikai Támogatás Doktrína (3. kiadás).” Budapest: HVK Logisztikai Csoportfőnökség, 2015.

Marashdeh, Mohammad J. *Logistic Support Planning for New Aircraft Weapon Systems*: Defense Technical Information Center, 1988. <https://doi.org/10.21236/ADA202043>.

“Military Aircraft Ground Support Equipment Roles.” Accessed October 20, 2025. <https://www.governmentprocurement.com/news/military-aircraft-ground-support-equipment>.

Nyitrai Mihály. “A NATO műveleti logisztikai támogatás vizsgálata többszemponútú döntéselőkészítési módszerrel.” PhD, Nemzeti Közszolgálati Egyetem, 2023. <https://doi.org/10.17625/NKE.2023.027>.

Pretorius, Petrus Johannes. *A Generic Approach to Integrated Logistic Support for Whole-Life Whole-Systems*. 2002.

Reiter, Thomas E. *USAF Aircraft Maintenance Organizational Structure: Where We’ve Been, Where We Are, What’s the Future*: Defense Technical Information Center, 1988. <https://doi.org/10.21236/ADA202701>.

Serrano, Aldemar, Dusko Kalenatic, Cesar López, and Jairo R. Montoya-Torres. “Evolution of Military Logistics.” *Logistics* 7, no. 2 (2023): 22. <https://doi.org/10.3390/logistics7020022>.

Simon, Steve John. “The Art of Military Logistics.” *Communications of the ACM* 44, no. 6 (2001): 62–66. <https://doi.org/10.1145/376134.376167>.

Valtonen, Ilari, Samu Rautio, and Mika Salmi. “Capability Development in Hybrid Organizations: Enhancing Military Logistics with Additive

Manufacturing.” *Progress in Additive Manufacturing* 7, no. 5 (2022): 1037–52. <https://doi.org/10.1007/s40964-022-00280-z>.

Van Fenema, Paul C., and Ton Van Kampen. “Foundational Concepts of Military Logistics.” In *Handbook of Military Sciences*, edited by Anders McD Sookermany. Springer International Publishing, 2021. https://doi.org/10.1007/978-3-030-02866-4_71-1.