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ELEMENTS OF MONITORING AND CONDUCTING EFFICIENT LOGISTICS TRANSPORTS TO SUPPORT TACTICAL AND JOINT OPERATIONS WITH NATIONAL AND MULTINATIONAL STATUS WITHIN THE FRAMEWORK OF NATO

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ABSTRACT

Secure and efficient logistics transportation plays a fundamental role in the success of tactical and joint operations, both national and multinational, within NATO. In the context of the diverse and unpredictable threats in today's geopolitical landscape, maintaining functional military supply and distribution chains becomes essential. This article highlights the need to protect logistics transportation at the tactical and/or joint level, directly correlated with the timely delivery of resources to combat and support units, which requires the use of modern management and monitoring technologies. All of this depends on the methods and skills involved in successfully carrying out logistics transportation, both in the specific phases of force deployment in the multinational operational theater and subsequently, to accomplish the assigned mission and achieve the final state.

KEYWORDS: tactical operations, joint operations, logistics transports, resilience, supply-distribution chains, risk management, modern technologies

1. Introduction

Logistics transport plays an essential role in the success of tactical and joint military operations, both at the national and multinational levels within NATO. In a dynamic geopolitical landscape, where threats are varied and unpredictable, maintaining resilient supply-distribution chains becomes major, implying that efficient monitoring and development of logistics transports are essential for the success of military operations, at the levels above.

Within tactical and joint operations, the efficiency of logistics transports is reflected in the ability to deliver the necessary resources at the right time and in the right place, which implies not only the rigorous planning of routes and delivery times but also the integration of modern technologies, such as real-time monitoring systems and data management solutions. This reveals the functioning of efficient logistics transport structures, dynamically and resiliently involved in the Just-in-Time replenishment of operational forces, for the success of missions and achieving the final state.

The conduct of hostilities by the opposing forces in the high-intensity armed conflict in Ukraine has demonstrated, by the statements of the former NATO

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Secretary General – Jens Stoltenberg, that a war of attrition is being waged, the outcome of which for Ukraine will depend on the battle of logistics. Hence, operational logistical transport at the tactical and joint levels is important both within the mobility mechanism and in resupplying equipment and material (consumable and non-consumable) (Allied Command Transformation, 2023).

The integration of military logistics transport platforms is an essential element in optimizing and streamlining operations for the mobilization and supply of operational forces. These platforms, which include transport vehicles, aircraft, and specialized ships, must be interconnected in a coherent system, capable of responding quickly and accurately to the movement needs of troops and equipment in a complex operational setting. By using advanced communication and coordination technologies, the integration of these platforms ensures fast and secure logistics flows, minimizing reaction time and maximizing resource efficiency. In addition, good integration allows rapid adaptation to changes in joint theaters of operations, ensuring strategic and tactical mobility more flexibly and efficiently (AJP-4.4, 2022). In Figure no. 1 I present several logistic transport platforms, possibly used to provide logistical support through transport at the tactical and joint levels.

Figure no. 1: *Images of transport platforms that exist for Logistical support at the tactical and joint levels*
(Sources: NATO Response Force, 2023; AJP-3.13, 2021; NATO, 2025; DA Staff, 2024; NATO, 2023; Rheinmetall, 2024)

At the tactical and joint levels, cooperation between the different combat structures integrated into the operational components and between troop-contributing nations becomes vital. Multinational collaboration allows for sharing of resources and information, based on clear communication protocols, procedures, and workflows that allow for a harmonious integration of logistical transport resources (military and civilian) in complex scenarios, thus facilitating a faster and more coordinated response to emerging challenges and actions. Information compartmentalization and coordination of actions are successful facilities that contribute to the efficiency of logistical transports to support tactical and joint operations with national and multinational status. By integrating common monitoring platforms, operational teams can react quickly to changes in the situation, thus ensuring the continuity of logistical transport

operations and the protection of the personnel involved. In this context, interoperability initiatives and standardization of logistical transport procedures become priorities to ensure efficient integration between the different forces and agencies involved in the joint operation, according to Figure no. 2 (Minculete, 2024).

Therefore, the planning and safe conduct of logistical transport is the foundation for the success of military operations at the tactical and joint levels in an allied context, requiring a proactive and innovative approach. By adopting adaptable concepts of action and through effective multinational collaboration within the NATO framework, allied combat forces, effectively engaged in tactical and joint operations, can ensure not only the efficiency of their logistical transport support but also national, and regional security and global stability.

The actual realization of the article within the specific research process involved the adequate creation of sequences two and three, respectively − *monitoring logistical transports at tactical and joint levels in operations with national and multinational status for efficiency* and *characteristics of conducting multimodal and intermodal logistic transport operations in tactical and joint operations with national and multinational status*. To this end, I proceeded to identify, analyze, compare, evaluate, transform, and adapt the information and data necessary to achieve the research objectives and achieve the expected contents.

2. Monitoring Logistical Transports at Tactical and Joint Levels in Operations with National and Multinational Status for Efficiency and Resilience Purposes

The challenges and vulnerabilities of logistical transport at the tactical and joint levels in operations with national and multinational status reveal specific elements. Thus, at the tactical level, vulnerabilities may include as main risks: attacks on logistical convoys; transportation difficulties in hostile or inaccessible terrain; and frequent disruptions of supply-delivery (distribution) chains. Here, I believe that NATO's efforts to reduce these vulnerabilities by protecting supply-distribution lines and optimizing logistical routes in the tactical field must be evident. At the joint level, the vulnerabilities of logistical transport, which require appropriate protective interventions, careful analysis by competent profile bodies, especially on: dependence on air or naval transport; exposure of integrated logistical networks to enemy cyber-attacks; difficulty in synchronizing transports between various combat forces designated by NATO member states based on agreements and memoranda of understanding (Council of the European Union, 2018; AJP-4.4, 2022).

Appropriate measures to counter challenges and prevent risks to logistical transport at tactical levels in operations with national and multinational status would mainly involve: analysis and assessment of the types of risks that may arise (e.g. attacks, extreme weather conditions, problems specific to logistical resupply) and appropriate measures; efficient planning and coordination of logistical transport by specialized teams operating with maps and modern technologies; use of advanced communication systems, including radio stations and monitoring equipment; the existence of drones useful in reconnaissance and material delivery activities, to reduce risks; action of intervention teams formed by trained soldiers who will act with rapid response equipment, to counter potential threats; the resilient operation of a joint movement and transport coordination center within the Joint Logistic Support Group (JLSG), in which representatives of various nations participating with forces in the joint multinational operation within NATO will work collaboratively; personnel participating in training sessions on risk management and logistics transport safety at the tactical and joint levels (Kinsey & Ti, 2023).

The logistic transports are specific to the tactical and joint multinational operations and will be ensured by the profile structures of the troop-contributing nations (TCNs), JLSG, and specialized contractors through the established modes of transport. These have the role of facilitating the flows of logistic resources (specialized personnel in the fields of logistic support, equipment, and materials) within the supply-delivery chains that operate within the logistic support lines and between them. The means of transport existing within the multinational (combat and support) tactical and/or joint action forces have dimensions and capabilities in accordance with the requirements of the missions to be carried out by the logistic support execution structures (which include trucks, transport aircraft, logistic and commercial ships, military and commercial trains (trainsets), air and/or land transport drones, etc.), to support the operational effort (North Atlantic Treaty Organization, 2020).

After the force is integrated into the tactical and joint multinational combat devices, the national logistics structures within the unit-level combat forces will provide logistical support to their subunits through resupply transports from the subordinate logistics company to the (similar) combat supply points of the combat and support companies. The logistical support of the tactical unit will be carried out by the National Support Element (NSE) designated by the TCN, which promptly carries out this process through material transports according to the requests received. Furthermore, the NSE will be responsible for monitoring and utilizing the Host Nation Support (HNS) – by the provisions of the agreements in force – and its communications with the TCN, to meet the logistical support objectives for the force it supports within the framework of the joint multinational mission until the end, but also during the process of its redeployment. At the same time, NSE will also communicate and collaborate with the support elements of the other nations participating in the joint multinational operation, highlighting and requesting the resolution of any malfunctions (North Atlantic Treaty Organization, 2020).

Even though ships, railways and air vehicles are involved in the processes and logistical flows of providing equipment and materials (non-consumable and consumable) necessary for beneficiaries (fighters and equipment) planned and carried out within military supply-distribution chains, however, through transport involving motor vehicles (with compression ignition) or electric vehicles, tactical and/or joint commanders can ensure the operational mobility necessary to defeat the enemy and force him to surrender (Doreus, 2021).

Within the command point of the tactical or joint echelon, the team from the movement and transport compartment or office of the logistics module (S4, G4, A4, J4) collaborates with the map(s) displayed on tables and large monitors, showing transport routes, vehicle status and monitoring logistics transports in real-time with the help of technology, while applying security measures through the use of specific protective equipment (Minculete, GMR Nr. 2/2023). Here, surveillance drones, communication equipment, and simulations of response exercises can be integrated. Real-time monitoring screens are displayed on the walls, with data on logistical transports, weather conditions, and possible threats. Specialists communicate (when necessary also through headsets) and discuss mission coordination, using tablets or laptops to access critical information. The atmosphere is dynamic and focused, with each member (of the aforementioned movement and transport compartment or office) having an essential role in the success of logistical transport operations at the tactical and joint levels in a national and/or multinational context.

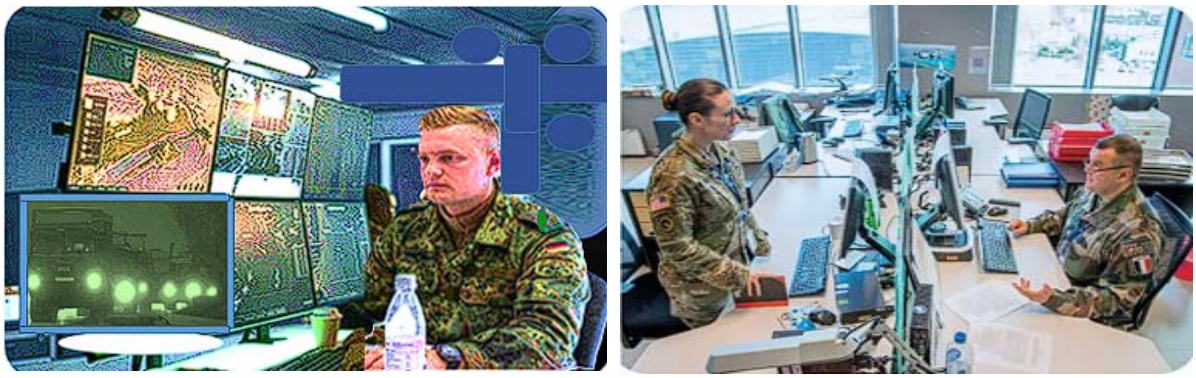
Monitoring of logistics transport protection actions at the tactical level differs mainly from that at the joint level in terms of scale, complexity, and coordination.

Thus, monitoring at the tactical level is characterized by: local focus, i.e. it focuses on specific activities and local missions, specific to the execution of logistics transports in a restricted geographical area; limited resources, i.e. means of transport are using available logistical resources, according to the requirements of large units and units operating in tactical operations areas; decisions made quickly based on information and immediate responses to current situations, based on local risk assessment; collaboration between units involving coordination between various logistics transport monitoring teams, belonging to large units and units integrated into tactical operations areas.

Joint monitoring of logistics transports is dependent on: a broad focus involving coordination between different services and agencies at the national or multinational level; integrated resources of great diversity, including artificial intelligence, information from various sources, and advanced technologies; complex long-term planning: requires detailed analysis, considering the interactions between different operational forces and agencies; multinational coordination, which may involve collaboration with allies and international partners, to ensure that all parties are informed and aligned on applicable security concepts and procedures (Burke & Gaumer, 2017).

Specific movement control missions vary considerably depending on the specific requirements of each area; however, they generally involve some degree of subsequent movement coordination with appropriate agencies, execution of vehicle inspection and provision of movement coordination services to multinational combat units, which includes assisting them, supporting them with documentation, managing deployment automation, and providing movement control assistance in hubs (Paone & Westrom, 2017).

In Figure no. 2, I highlight the process of monitoring logistical transports, by specialists from the specialized leadership structures at the tactical (a) and joint (b) levels, for continuous protection of vehicle columns moving towards tactical or joint combat structures integrated in operations with national and multinational status.



a) b)

Figure no. 2: *Images regarding real-time monitoring of logistical transports, for protection purposes, at tactical (a) and joint (b) levels in a national or multinational context*
(Sources: Riga 2018; Youtube, 2024; Shutterstock, 2024)

Therefore, monitoring logistics transport at the tactical and joint levels is essential for ensuring efficiency and resilience in operations with national and multinational status. By using advanced tracking technologies, such as Global Positioning System (GPS) and supply chain management platforms, armed forces can gain real-time visibility into the flow of resources. This monitoring allows not only

to optimize transport routes and reduce delivery times but also to anticipate and quickly manage potential disruptions, such as attacks or adverse weather conditions. At the same time, by monitoring the protective actions of logistics transport, it is important to note that at the tactical level it focuses on immediate actions in the respective area of operations, while at the joint level, it involves a broader vision and complex coordination between different military logistics transport organizations belonging to the TCNs for tactical and joint multinational operations.

3. Characteristics of Conducting Multimodal and Intermodal Logistic Transport Operations in Tactical and Joint Operations with National and Multinational Status

• ***General details***

The movement (displacement) of equipment and materials (non-consumable and consumable) in the area of multinational joint operations/operating theater (OT), from the third line of logistical support to the second line of logistical support and then to the first lines of logistical support (at brigade and battalion level), determines the existence of a supply - delivery (distribution) chain that includes adequate infrastructure elements about: existing military and civilian warehouses within the transport-storage structures or independently; contractors supporting the operations; adequate means of transport (on wheels; on rail; on water); sufficient transport routes; adequate resilience and protection measures, etc. Figure no. 3 highlights theater-specific transport flows for multinational joint operations.

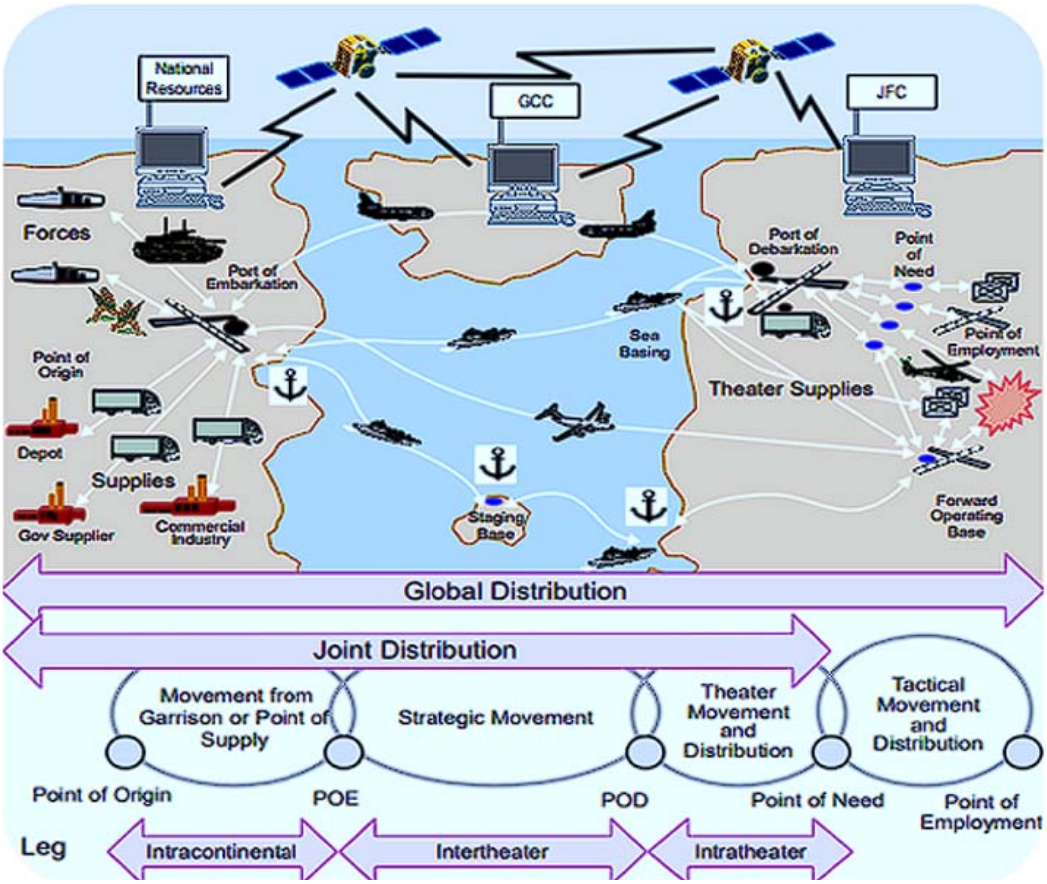


Figure no. 3: *Flows related to the multimodal transport mechanism for the deployment and integration of the joint force within the multinational theater of operations*
(Source: JP 4-09, 2013)

For the logistical support of the troops, both the structures specialized in the execution of logistical support (of national and/or multinational nature) and the battle supply points (BSP) of the tactical operational structures at the company level operate through transport operations carried out by motor vehicles from the organic (trucks; tracked vehicles; drones). Under these conditions, for the success of the missions, it is necessary to carry out end-to-end logistical transports with the help of motor transport vehicles, their drivers, and maintenance operators. Therefore, these resources will ensure the provision of the necessary equipment and materials (by NATO supply classes) to the combat forces, to accomplish the missions and achieve the final operational state (JP 4-09, 2013).

The two replenishment methods *Pus*h and *Pull* are each dependent, in the application processes, on two other methods, namely: the *Hub and Spoke Method* and the *Linear Method.* These distribution systems are achieved by connecting hubs (sources: military or economic operators' depots, etc.) with the depots of the combatant structures through transport circuits included in transport runs, which in turn are part of the replenishment days and/or nights in which the operational forces operate.

Figure no. 4 shows the functional model of the *Hub and Spoke Method*. An interpretation of the three hubs in the figure can be made, considering the movements of materials that are made between the logistic support lines/LSLs in the multinational operations area/theater, according to what is revealed below. The first hub (on the left) can represent (taking into account the North American military organization): theater logistics base/TLB of the joint logistics support group located in the third line of logistic support (TLB/JLSG/3rd LSL); support brigade/SBDE (similar) of the land component command/LCC of the multinational joint force/MJTF (which may be a corps) located in the third line of logistic support (SBDE/LCC/MJTF/3rd LSL, considered Corp Support Area-CSA); support brigade (similar) of an armored division (AD) of the land component located in the second line of logistic support of division (SBDE/AD/ LCC/2nd LSL/D, considered Division Support Area - DSA); support battalion/SBN (similar) of an armored brigade/ABDE within an infantry division/ID of the LCC located in the first line of logistic support/1stLSL (SBN/ ABDE/ID/LCC/1stLSL, considered Brigade Support Area-BSA); the support company/ SCo (similar) of an armored battalion/ABN from organic an armored brigade of the infantry division of the LCC (SCo/ABN/ ABDE/ID/LCC/1st LSL, considered Service Support Company-SSCo). The next hub (on the right) may represent a logistics support execution structure one level lower from which the spokes leave for the lower hubs because the last (distribution structure as a hub) will be represented by SCo/ABN (Minculete, 2024).

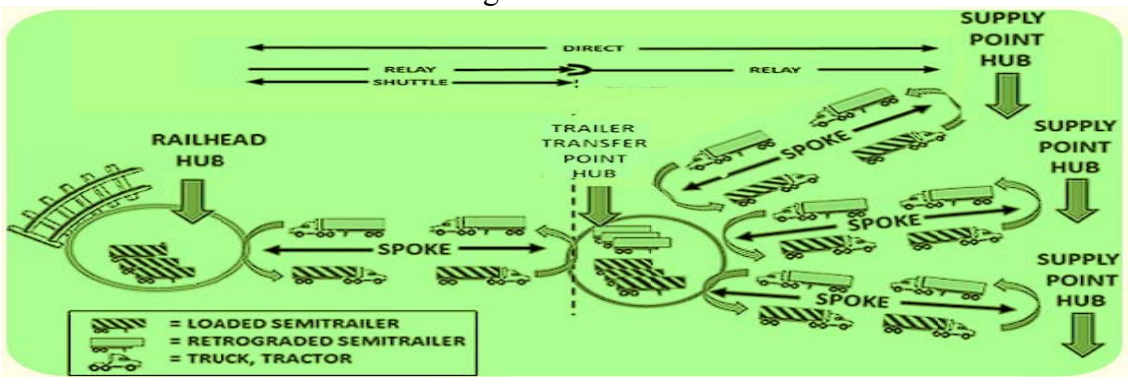
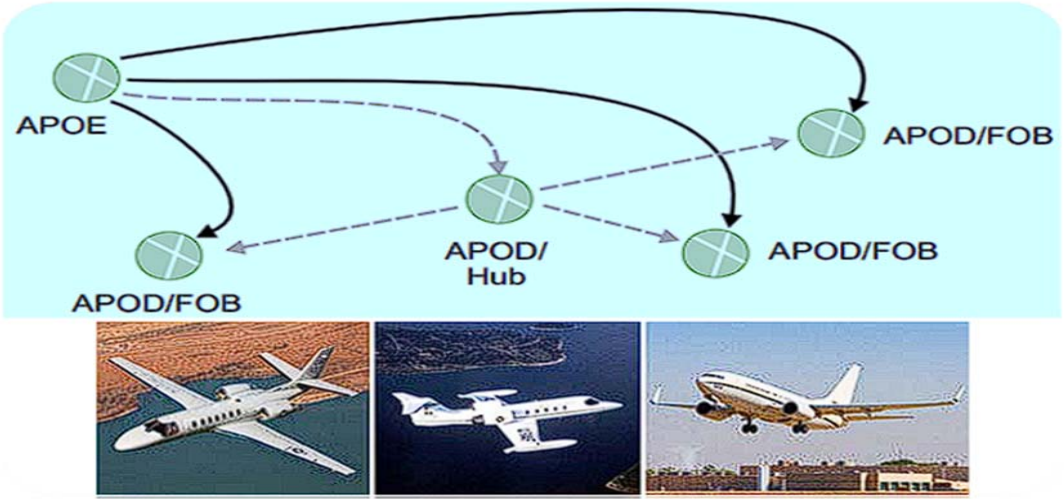


Figure no. 4: *An image of the application of the hub and spokes method*
(Source: adapted from ATP 4-11, 2020)

Hub and spoke operations integrate air transport between and within theaters. Beginning with an aerial port of embarkation/ APOE, intertheater air operations transit deployment bases along the route, ultimately arriving at a primary operating base aerial port of debarkation/APOD (AFDP 3-36, 2024). Intertheater air operations typically involve the landing of personnel and materiel at a theater's primary operating location (APOD). Subsequently, designated personnel and equipment are moved to forward operating bases (FOBs) by intratheater airlift from the APOD. Direct delivery (by airlift) from an APOE to FOBs in the Multinational Joint Area of Operations (MJAOO)/Theater can also be accomplished. As a secure location for transfer operations (containerized products, equipment, and materiel), an APOE or APOD represents a Hub and Spoke (Figure no. 5) that allows planners to maximize the capabilities of each aircraft type, thus avoiding flights to high-risk or contaminated locations. However, direct delivery by air transport is not the best solution for intensive material demands (after one or more air transports have been carried out), when there are multiple FOBs to be served (JP 3-17, 2019).

Military air transport between APOEs and APODs plays a vital role in the success of military operations, facilitating the rapid movement of forces and equipment essential for missions. In this context, APOEs represent the departure points for loading equipment and personnel, while APODs are the arrival locations where goods are unloaded and distributed for operational use. These air transports involve significant logistical complexity, as they require coordination between different agencies and military forces to ensure the rapid and safe handling of cargo, as well as adherence to security measures. Their efficiency depends on the ability of military airports to handle aircraft quickly and the implementation of an air traffic management system that allows for coordinated aircraft movements, thus reducing delays and risks. Furthermore, these transports require thorough preparation of crews, loading and unloading equipment, and transport infrastructure to ensure the success of operations in an often unstable and challenging environment (JP 3-17, 2019).

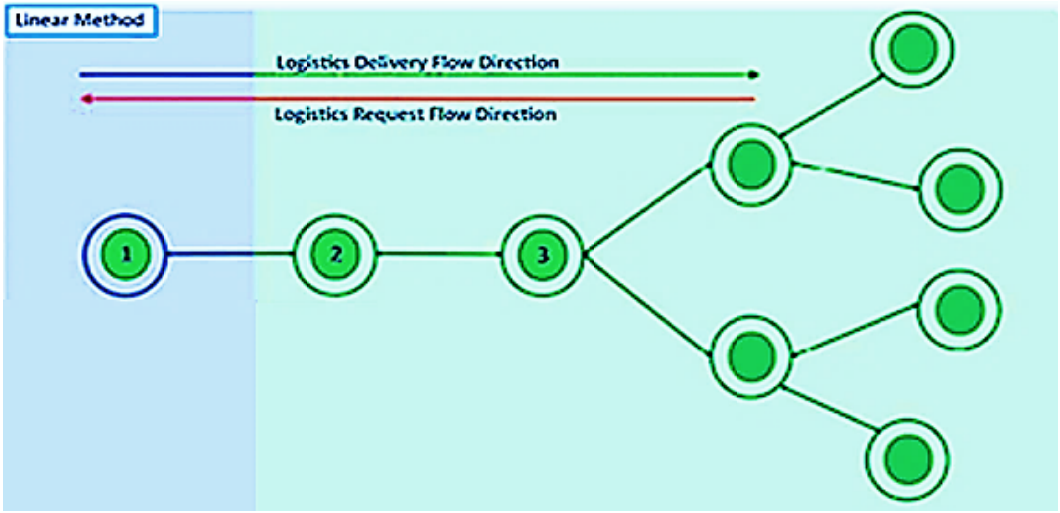


Legend

- ✓ APOE = Aerial Port of Embarkation;
- ✓ APOD = Aerial Port of Debarkation;
- ✓ FOB = Forward Operating Base;
- ✓ hub and spoke
- ✓ direct delivery

Figure no. 5: *Distribution (delivery) by hub and spoke and direct delivery methods*
(Source: adapted from JP 3-17, 2019)

Compared to the *Hub and Spokes Method*, the *Linear Method* is applied to companies and platoons (similar) from combat and support forces, because the transport circuits are simpler for the logistical sustainment. Here, the transports are carried out directly to the soldiers and the combat equipment (systems) and include a limited number of nodes (hubs) with direct circuits (spokes), appropriate for a simplified logistical process, but which must be protected. So, here, there is less flexibility regarding deliveries, due to the few transfer points with a positive impact on minimizing delays and effective and efficient coordination of transports at the lower tactical level (Minculete, 2024). Figure no. 6 highlights the appropriate model of the demand-resupply system, through road transport at the tactical level, which generates the specific flow between the logistics battalion of a brigade (nationally or multi-nationally employed) and the logistics company of a subordinate battalion (through the logistics platoon in the structure), continuing with the combat supply point of a company within its organization, then with platoons and groups (Minculete, GMR No. 2/2023).



Legend:

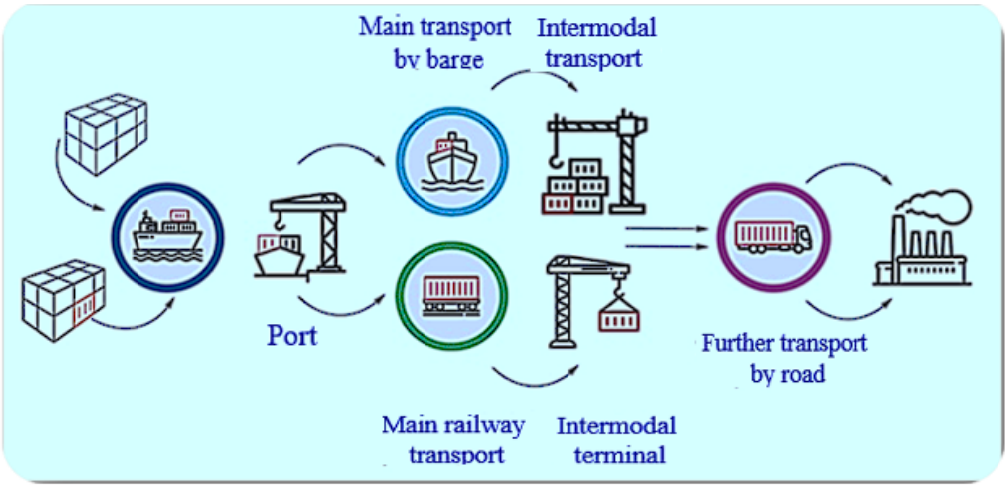
1. SBN/ABDE = support battalion-SBN of an armored brigade-ABDE;
2. SCo/ABN = support company-SCo of an armored battalion-ABN;
3. BSP/ACo = battle supply point of a armored company- ACo;

PLT → GP = platoon → group.

Figure no. 6: *A generic view of the "Linear Method" at a tactical level*
(Source: adapted from Ekman, 2017)

In general, intermodal transport of goods consists of moving them loaded in containers, mobile boxes, semi-trailers, etc., without unloading and separate handling, by combining road, rail, sea, river or air transport modes. In general, several main advantages of intermodal transport are noted, such as: *"reduction of the carbon footprint; reduced costs compared to road transport; reduction of logistics costs; reduction of downtime; much higher loading capacity compared to road transport; cargo safety; constant transport, without traffic jams and restrictions; decongestion of road traffic; protection of infrastructure from overloading; GPS monitoring"* (A&N Logistik Intermodal Solutions, 2024).

Figure no. 7 highlights a generic example of intermodal transport in which the same cargo of goods existing in containers will be moved from the port of entry to the final recipient(s).



Note: Barge = ship (without its own propulsion) used for the transport of goods on rivers, canals or lakes.

Figure no. 7: *A variant of the logistics chain specific to intermodal transport of goods*
(Source: adapted from A&N Logistik Intermodal Solution, 2024)

Considering the specific military implications of multinational joint operations, it is important to know that in 2020, the European Commission proceeded to develop and publish the "Strategy for sustainable and smart mobility", which highlights the need to use intermodal transport that integrates more appropriate modes of movement of goods by means of: railway; specific to inland waterways; specific to short-distance maritime transport (i.e., the movement of goods and passengers by sea vessels "*between ports located in geographical Europe or between these ports and ports located in countries outside Europe that have a shore on the closed seas at the borders of Europe*"(COM, 2020)).

• ***Specific details***

Intermodal operations are the processes of using multiple modes (road, rail, air, sea) and means of transportation (trucks, barges, containers, pallets) to move troops, supplies, and equipment through expeditionary entry points and through a network of specialized transportation hubs to support land forces (ADP 4-0, 2019). They involve moving cargo and personnel using two or more modes of transportation (surface and air) from origin to destination to reduce cargo handling and thereby expedite delivery. These operations use movement control to balance demands against terminal and mode synchronization capabilities and capabilities, ensuring uninterrupted flow through the transportation system. Intermodal operations consist of facilities, transportation assets, and material-handling equipment (MHE) required to support deployment and distribution efforts. Terminal operations and container management are included in this function (FM 4-0, 2019).

To fulfill the missions of multinational joint forces with geographically dispersed assets, it is necessary to have a coordination system for the adequate matching of operational demand with logistical supply, which will determine, at the theater and industrial base level, the creation of flexible and adaptable logistical flows to complex and sometimes difficult to satisfy requests. In this regard, for the movement of large quantities of materials outside the highly contested operational areas, military and commercial ships, airplanes, trains, trucks, vans, and other means will be used. However, in order to avoid delays in the movement of goods (equipment and materials) to the recipient multinational combat structures, the interconnection of the aforementioned logistic transport vehicles will be carried out, according to

intermodal (transport) options (through multiple and varied logistic channels), so as to ensure their availability where necessary based on transport requests. In this way, by also capitalizing on information about the enemy's intentions and strike possibilities, logistical resources will reach military recipients faster (Estevez et al, 2021).

Terminal operations are vital for the movement and support of expeditionary forces, which are divided into strategic, operational and tactical levels. Terminal operations allow the transfer of equipment, cargo and forces from one mode and/or means of transport to another. In the case of containerized goods (products; equipment; materials), the transfer is carried out in most cases (as previously specified) without opening the containers, which maintains the integrity of the cargo and allows for shortening the movement time, due to the reduced or non-existent handling time. Terminals are vital in carrying out intermodal transport operations because they allow for the efficient implementation of the distribution processes of military goods (transport, storage-warehousing, handling) necessary to support the combat and support forces operating throughout the area of multinational joint operations. Therefore, operations are carried out in terminals that allow: the reception, processing and stationing of military personnel; receiving, storing, transiting and distributing the material resources necessary for troops deployed in the joint multinational theater of operations; loading and unloading means of transport; moving goods and military personnel of operational units according to the requirements of the RSOM (reception, staging, and onward movement).

Therefore, to carry out intermodal and/or multimodal transport, specific equipment, accessories, systems, services, and solutions are used, such as: *"pallets; containers; tank containers, special containers; interchangeable containers and superstructures; small and medium containers; air transport pallets; accessories; road vehicles for the transport of containers and interchangeable containers; railway vehicles for the transport of semi-trailers, interchangeable containers, and containers; railway vehicles for the transport of articulated vehicles; two-mode transport systems; roll on/roll off service and ferry transport; system solutions for combined transport"* (Minculete, 2024).

The transport of goods between TCNs and the multinational joint operations theater (MNJOT) includes a set of locations (nodes or hubs) for the efficiency of networks specific to the constituted transport chains. In simple terms, they include the particular functions of the quantities of goods (equipment and materials) integrated into intermodal transport flows, namely *constitution, transfer, exchange*, and *fragmentation* (Rodrigue, 2006) (Figure no. 8). These functions will be briefly discussed below.

- *Constituting* is the process of accumulating equipment and materials at a terminal that allows an intermodal interface between a local distribution system related to the multinational joint theater of operations (APOE, SPOE, RPOE) and a national distribution system related to each TCN.
- *Transfer* involves a consolidated modal flow depending on the type of pre-started transport linking the hubs involved in the deployment of operational forces in the MNJOT (APOE-APOD, SPOE-SPOD, RPOE-RPOD and from there to the theater logistics base or TLB), using air, naval and land transport means.
- *Exchange* refers to the major intermodal function that takes place at the mentioned terminals whose purpose is to ensure efficient continuity within a related transport chain.
- *Fragmentation.* The quantities of equipment and materials, by class, will be transferred (from the hubs shown in Transfer) into the theater distribution system which will involve transportation,

storage, warehousing, and distributions appropriate to the requirements of supporting forces engaged in multinational operations at the joint and tactical levels (involving logistic support lines three, two and one) (Minculete, 2024).

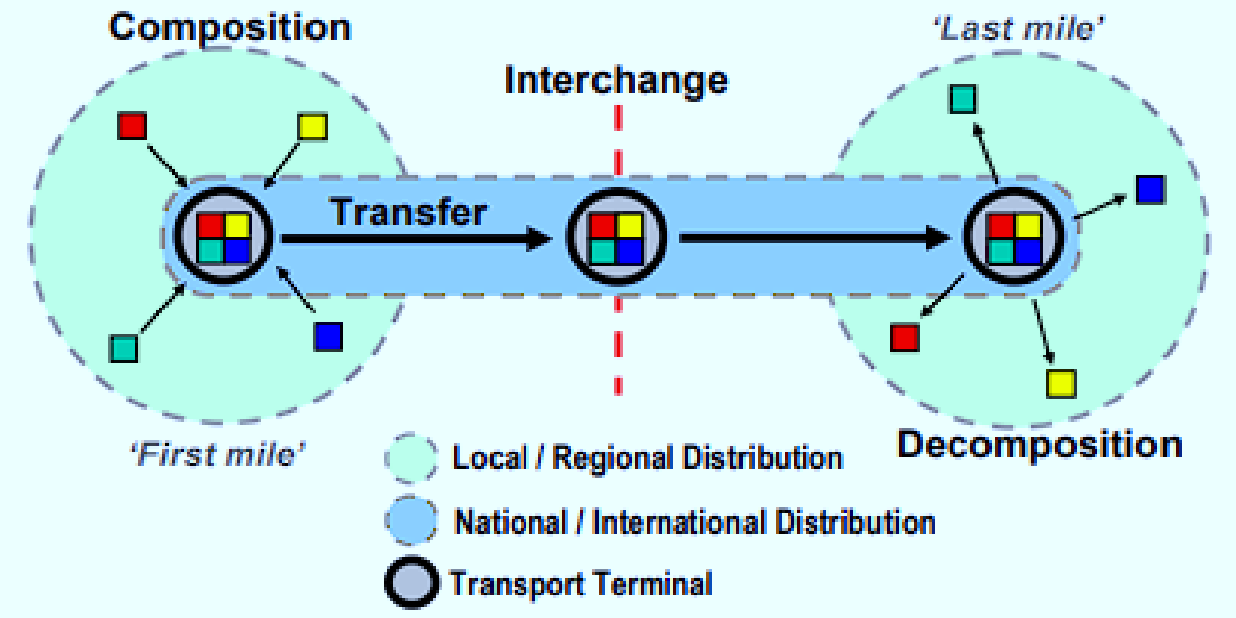


Figure no. 8: *The mechanism of military goods flows between intermodal transport hubs*
(Source: Rodrigue, 2006)

When conducting intermodal operations in support of NATO tactical and joint multinational operations, specifics of port and airport entry activities arise. Each host nation (HN) has its own laws and regulations. It is important that leaders (commanders) of national tactical structures, the multinational joint force commander, and the component staffs of the force categories clearly understand and consider these national agreements and warnings, which may affect the engagement and use of HNS capabilities. They can initiate dialogues regarding national agreements and issue warnings through advance-planning conferences with subordinates and partners. Figure no. 9 shows a generic picture of multimodal and intermodal transport operations.

Intermodal transport actions planned and conducted by multinational joint forces require multimodal resources and the use of appropriate military and civilian (commercial) assets, including in emergencies appropriate to support multidomain operations. The effective implementation modes of intermodal operations allow the combatant commander to ensure the flexibility necessary to deploy, engage, and support land forces to extend the operational range, ensure freedom of action, and have the necessary resilience during high-intensity operations (ATP 4-13, 2023).

Figure no. 9: *Images of container transfer (transshipment) in multimodal and intermodal transport operations*
(Sources: Estevez et al, 2021; Norwegian Defence Uni College, 2025; Mutăr, 2023)

For the proper planning and execution of intermodal transport operations, movement control actions are particularly important to: balance transport requirements and possibilities to terminal capacities; and synchronize and ensure uninterrupted flows of personnel and goods (equipment and materials) during high-intensity operations. At intermodal nodes, such as airports or landing airfields (APOD) and seaports of landing (SPOD), both equipment and intermodal platforms (e.g. transcontainers, containers, pallets, unitized cargo and equipment packages, etc.) will be unloaded, registered and transferred to a Keeping Area, to be then loaded and moved by authorized means of transport (trucks, rail cars, boats, barges and/or air transport) to the area(s) of multinational joint operations in the (profile) theater. In figure no. 10, a material transport column is noted, consisting of high-capacity transport trucks (IVECO) that can move materials into the MNJOT from one of the terminals where the equipment and materials necessary for the combat structures of the TCNs engaged in the areas of operations (AOO) (Minculete, 2024).

Once forces arrive in the theater of operations, the deployment of transports for the distribution of equipment, supplies, and personnel is done using various types of transport, adapted to the specifics of the area and operational needs. Road transport is often used to quickly move units and materials over short or medium distances, covering accessible routes and facilitating mobility in varied terrain. Trucks, armored personnel carriers, and light vehicles are essential for rapid tactical movements, especially in difficult environmental conditions or in areas where infrastructure is insufficiently developed. Depending on the nature of the operation, road transport can be coordinated with other types of transport to optimize distribution and efficiency (Smith & Young, 2018).

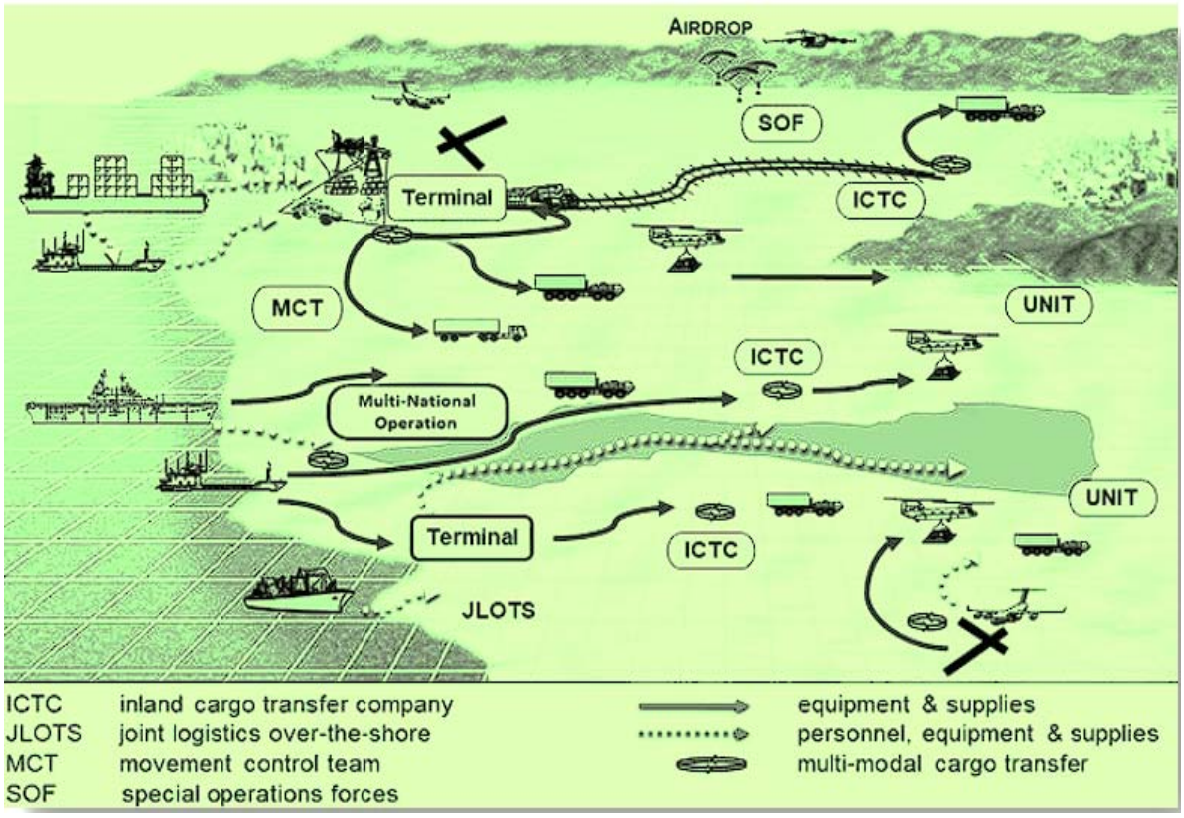


Figure no. 10: *Intermodal transport operational capabilities*
(Source: adapted from ATP 4-13, 2023)

For longer distances or in situations where rapid mobilization is essential, air transport plays an important role. Transport aircraft can be used to bring heavy equipment, troops, or essential materials to combat zones, having a significant impact on the speed of reaction and the ability to support missions in real-time. In parallel, naval transport can be used in theaters of operations located on the coasts or near maritime waters, transporting large quantities of supplies and equipment difficult to reach by other methods. Intermodality between air, road and naval transport ensures continuous and adaptable mobility, allowing forces to respond quickly to changes in the terrain and maintain

Automated service information systems provide visibility into the transfer of equipment and materials by changing from one mode of transport to another (considering intermodal or intramodal operations), facilitating the issuance of transport documentation and the shipping process through the use of radio frequency identification (RFID) tags. Furthermore, for onward movement (as phase of RSOM), the necessary documentation for the next mode(s) of transport is generated and prepared. Further, during the established and timely periods of implementation, intermodal transport operations will allow for the deployment, movement, and logistical support activities from mobile sea bases, intermediate support bases, seaports, airports (airports), railway stations, and inland and land terminals, including from austere and degraded access nodes and ports of entry, in all operational environments (ATP 4-16, 2022). Figure no. 11 shows the unloading of heavy equipment (including Abrams tanks and Bradley fighting vehicles) at the destination station, transferred to the rail convoy from SPOD.

Figure no. 11: *Image of the unloading of heavy equipment at the destination station, to be moved further into the operational area as part of a NATO multinational exercise held in Lithuania* (Source: Rempfer, 2020)

During these planning conferences, unreported warnings may be revealed that may require additional operational resources (including accommodation tasks) to be committed to unplanned (previously unconsidered) support. In this regard, operational planners will act proactively in establishing intermodal transport operations in the country where the joint multinational capabilities will be deployed (ATP.4-13, 2023). For their design and implementation, intermodal transport operations will be based on unified (joint) actions − significantly dependent on multinational partnerships. The latter are intended to allow for the improvement and expansion of the flexibility and mobility of multinational capabilities, to respond to (evolving) crises promptly. At the same time, through a coordinated process, intermodal transport operations will integrate the tasks and systems operating land, rail, air, sea, and river terminals, synchronizing these functions with the joint deployment and distribution action and the combatant commander's support concept. In addition, intermodal transport operations will allow: the transfer of forces and cargo from nodes and between modes of movement to meet the commander's operational requirements:

✓ rapid configuration, reconfiguration, and transfer of goods;

✓ multimodal transfer of cargo between land, air, rail, sea, and/or river platforms;

✓ surface movement and in-transit support of personnel, including combat-ready force elements and the civilian population;

✓ transportation automation systems necessary to establish and maintain visibility, and accountability, and enable in-transit visibility (ITV) and management of transportation assets (ATP.4-13, 2023).

4. Conclusions

Intermodal transport activities are conducted in all operational environments in which multinational joint forces operate. These include the ability to move from the destination location, through multimodal nodes, within TCNs, to and within the multinational joint theater of operations. During high-intensity operations, the demands on the supporting forces are

increased, thus requiring the logistics support execution structures to intervene agilely and flexibly when multimodal transport actions (operations) are to be conducted.

Movement control is an essential function subordinate to transport, which ensures that the resources required for multinational joint operations reach the right places and at the right times in the theater of operations. To establish the necessary security for the movement of military capabilities specific to TCNs from APODs, SPODs, and RPODs and then at the level of each support line in the multinational theater of operations, Movement Control Team (MCTs) operate with the task of providing the necessary support for controlling the movement of personnel, equipment and cargo, which move in/through the assigned areas.

At the tactical and joint action levels, multimodal and intermodal transport operations present several easy characteristics, as follows: multimodal logistic transport operations allow the use of different modes of transport (air, land, sea) to respond quickly to mobilization requirements, maximizing logistical efficiency; at the joint level, the integration of different combat forces involves the use of intermodal logistic transports, which facilitate coordination between land, air and naval tactical combat structures, ensuring a constant flow of resources; multimodal approaches contribute to reducing the time required to deploy forces on the ground, essential in critical situations, such as responding to crises or conflicts; diversification of logistic transport modes helps mitigate the risks associated with attacks on a single mode of transport, thus increasing the security of operations; despite the complexity, intermodal logistic transport operations can lead to reduced logistic costs by using the most efficient combinations of transport depending on the distance and type of cargo; the success of these multimodal and intramodal transport operations depends on the effective coordination between logistic and operational units, requiring advanced communication and information management systems; emerging technologies, such as GPS monitoring systems and supply-distribution chain management software, play a major role in facilitating multimodal and intermodal operations; training of military personnel in multimodal logistic transport processes is essential, in order to ensure efficient and rapid support within joint operations with national and/or multinational status.

It follows, therefore, that the specific elements of monitoring and conducting efficient logistic transport are essential for supporting tactical and joint operations within NATO. By integrating modern technologies, rigorous planning, risk assessment, and constant training, operational forces can ensure mission success in complex and challenging environments. This holistic approach not only supports the effectiveness of operations but also strengthens international partnerships, thus contributing to collective security. In conclusion, the design and implementation of effective logistics transport in tactical and joint operations, with national and/or multinational status, involves a high degree of coordination, adaptability, and interoperability between different platforms and nations. Careful planning and optimal use of logistics transport resources, combined with modern technology and innovations, contribute to the projected success of these complex operations.

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