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RELATIONAL APPROACHES TO DESIGNING THE USE OF GROUND LOGISTICS TRANSPORT DRONES IN HIGHLY CONTESTED TACTICAL OPERATIONAL ENVIRONMENTS

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Abstract: *The conflict in Ukraine has highlighted hybrid combat environments, with continuous attacks using drones, drone swarms, artillery, rockets, and electromagnetic jamming, putting pressure on sustaining tactical unit operations. To support combat structures, Unmanned Ground Vehicles (UGVs) are increasingly analyzed and employed to transport ammunition, light equipment, and supplies into heavily contested areas. In this article, we do not aim at technological development of drones but rather to examine their efficient use for prompt on-demand resupply, focusing on quantitative and deterministic projections under the mentioned tactical conditions for 120 mm ammunition. Using a methodological model based on hypothetical data, we determined optimal transport per delivery run, the duration of each, and the overall mission, considering potential losses and protective measures, thereby increasing logistical resilience and reducing personnel exposure.*

Keywords: contested operational environment; tactical operations; UGV-based logistical support; employment of UGVs; UGV transport missions.

1. INTRODUCTION

The armed conflict in Ukraine has accelerated the adoption of technological solutions that, until recently, were tested primarily in experimental contexts. Although media attention has focused predominantly on aerial drones and autonomous weapon systems, the use of unmanned ground vehicles (UGVs) for providing operational logistical support at the tactical level represents a less visible element, yet one with a significant impact on the conduct of operations. In an operational environment characterized by constant threats and high personnel losses, the integration of such systems contributes to maintaining supply flows and reducing the direct exposure of military personnel [1], [2].

Military logistics has always been a decisive factor in the success of tactical operations, and the conflict in Ukraine provides a relevant framework for analysing how autonomous technologies can reshape the structure and functioning of traditional logistic chains. In this context, UGVs should not be viewed merely as technological solutions but as instruments that influence military doctrines, tactical operational planning, and risk management [3].

The present study highlights the necessity of real-time coordination in order to provide immediate logistic support (Just-in-Time) using UGVs between command officers and logistics execution personnel, including transport and maintenance engineers. There is a clear interest in ensuring that these unmanned systems operate within the expected performance parameters so that tactical-level resupply transport requirements are fully met.

To achieve this objective, the research seeks to address questions regarding the extent to which UGVs can ensure the continuity of logistic flows in contested tactical environments, the conditions under which they can function as a complementary or alternative solution to conventional transport, and the factors that influence their effectiveness in supporting combat units [4].

Currently, there are increasing challenges in providing the operational logistic support required by integrated forces operating in highly contested tactical environments, due to the elevated risks faced by engaged personnel and the equipment employed [1]. In such environments, unmanned ground vehicles (UGVs), or "ground logistics drones," are becoming critical means for transporting essential materials and equipment, reducing personnel exposure and enhancing operational resilience [2].

Recent developments in the high-intensity armed conflict in Ukraine demonstrate that UGVs can be used for the rapid delivery of ammunition, casualty evacuation, or the transport of supplies in areas partially controlled by the enemy, where the use of conventional means would be extremely risky [3]. However, in order to maximize efficiency, it is necessary to assess the logistical concept of employment (planning and execution), the number of missions, transport capacity (including evacuated loads), and the risk of losses caused by the adversary, which requires methodological optimisation approaches.

The purpose of this study is to present a model for designing the employment of ground logistics drones (UGVs), based on a concise and hypothetical tactical scenario in a highly contested operational environment, by analysing total transport time, number of missions, and potential losses.

In order to achieve the objectives derived from the purpose of the research, it is necessary to address the following research questions: How do the number of UGVs and the planned missions influence the total transport time of critical materials in operational environments? Could an optimal planning and employment model for logistics transport UGVs be used under highly contested tactical conditions?

For the stated purpose, the following actions were undertaken: the analysis and evaluation of transport missions conducted with UGVs in a high-risk operational environment; the quantitative determination of the time required for employing existing logistics transport UGVs, as well as the assessment of potential losses.

2. RELATIONAL FRAMEWORK FOR THE OPERATIONAL EMPLOYMENT OF GROUND LOGISTICS TRANSPORT DRONES

The accelerated development of autonomous technologies has generated not merely technological innovation, but a structural reconfiguration of tactical-level military logistics. In highly contested operational environments, logistics must be conceptualized relationally, as an interconnected system linking material flows, operational risk exposure, command-and-control processes, and information dynamics. Within this framework, the sustainability of combat operations depends on the resilience of these interdependencies rather than solely on transport capacity.

In the traditional logistics model, the distribution of resources from depots to forward-deployed units entails continuous exposure of personnel and transport assets to aerial threats, indirect fire, and persistent surveillance systems. In contemporary conflicts characterized by high technological sophistication and lethality, this vulnerability becomes a decisive factor directly influencing the sustainability of offensive operations [4], [5]. The compression of sensor-to-shooter cycles and the proliferation of ISR capabilities transform logistical nodes and mobility corridors into priority targets, increasing systemic fragility within sustainment chains. In this operational context, ground logistics transport drones-operationalized through

unmanned ground vehicles (UGVs)-should be understood not merely as technological substitutes, but as relational instruments that recalibrate the interaction between risk, mobility, and sustainment continuity. By assuming high-risk missions such as ammunition resupply, delivery of Class I–V supplies, and medical evacuation, UGVs partially decouple logistical functions from the physical presence of personnel, enabling continuity of support in contested areas where conventional assets would incur disproportionate losses [6]. Their operational value must therefore be assessed not only in terms of technical specifications, but in relation to their capacity to preserve combat power by redistributing risk within the tactical system.

Within supply chains specific to advanced tactical operations, the integration of UGVs supports the digitalization of command-and-control processes through their incorporation into interoperable logistical infrastructures. These platforms function as mobile nodes within networked systems, continuously collecting and transmitting data regarding resource consumption, cargo status, route progression, and mission completion. This real-time information flow reduces the temporal gap between operational requirements and actual deliveries, enabling adaptive logistical decision-making aligned with NATO's digital transformation strategy [7]. Consequently, the employment of ground logistics drones strengthens the relational coherence between information superiority and sustainment effectiveness.

In response to evolving tactical requirements, U.S. defence agencies have developed the autonomous logistical support system known as the "robotic mule," designed to accompany maneuver units across multiple operational scenarios. The platform transports personnel within formations at speeds of up to 8 km/h across varied terrain, delivers Class I–V supplies including rations, ammunition, and fuel from Combat Supply Points (CSPs) to platoon-level positions with loads of up to 500 kg per mission, and evacuates injured personnel from frontline positions to Casualty Collection Points (CCPs) and subsequently to Role I Medical Treatment Facilities (MTF Role I). Under optimal conditions, it can cover 500 meters in approximately 3–4 minutes, or up to 15 minutes in operational environments. Additionally, it provides auxiliary capabilities such as battery recharging for vehicles and other critical equipment. Through autonomous navigation, real-time obstacle detection, load optimisation , and adaptive route planning, the system achieves approximately 20 km of operational autonomy per mission cycle, thereby reducing personnel exposure in high-risk areas [8], [16].

From a relational design perspective, such systems do not merely extend logistical reach; they restructure the interaction between maneuver elements, sustainment assets, and command networks. Designing the operational employment of ground logistics transport drones therefore requires a systemic approach that integrates risk redistribution, digital interoperability, and adaptive mobility within contested tactical environments. Only through this relational framework can these platforms effectively enhance logistical sustainability under conditions of persistent threat.

In Figure 1, we illustrate a relational operational configuration in which ground logistics transport drones (UGVs), protected and supported by UAVs, are employed to ensure the resupply of critical materials to the Combat Supply Points (CSPs) of first-echelon companies within the defensive disposition of a mechanized infantry battalion operating in a highly contested tactical environment. The configuration highlights the interdependence between ground autonomous transport, aerial overwatch, and command-and-control integration in mitigating risk and sustaining forward elements.

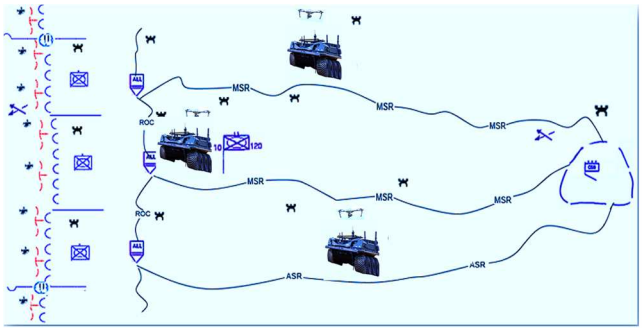


Fig. 1. Relational schematic configuration of ground logistics drones, illustrating the interdependence between autonomous transport and aerial overwatch for the resupply of ammunition to the Combat Supply Points (CSPs) of first-echelon mechanized infantry companies within the mechanized infantry battalion [8], [13].

Taking into account the imperative of minimizing losses in both human and material logistical resources particularly during the resupply of combat units operating in tactical scenarios across extended areas Alliance specialists are exploring and analysing multiple relational approaches to the operational employment of autonomous ground logistics drones. These studies focus on the deployment, coordinated movement, and protection of unmanned ground vehicles (UGVs), operating either individually or in organized convoys, in conjunction with supporting unmanned aerial vehicles (UAVs) [9], [12].

Autonomous robotic logistics systems for ground transport are not intended to replace human decision-making; rather, they redefine its role within a hybrid relational framework, in which humans retain command authority while UGVs assume high-risk physical tasks. The modular architecture of transport UGVs allows for simultaneous execution of multiple logistical functions, enhancing both interoperability and doctrinal flexibility across tactical combat units. This modularity also facilitates the incremental integration of autonomous platforms into existing structures without introducing major operational or organisational disruptions [10], [5], [14].

An empirical example of this relational operational design is provided by Ukraine's tactical forces, which have progressively integrated unmanned ground vehicles at the brigade level. These platforms support resupply of exposed positions, medical evacuation, and transport of critical equipment in high-risk or restricted-access areas, effectively redistributing operational risk away from personnel while sustaining the tempo of tactical missions [11], [15]. This practical application underscores the relational principle: the operational value of UGVs emerges from their integration into a network of units, information flows, and protective systems rather than from isolated technical capabilities.

3. METHODOLOGY

For the operational employment of UGV-based ground logistics transport at the tactical level, I elaborated a case study using a synthetic scenario informed by lessons learned from high-intensity armed operations in Ukraine. The scenario highlights the relational dynamics between autonomous transport platforms, supporting UAVs, command-and-control networks, and combat units, illustrating how these interactions can be optimised to sustain logistical flows under conditions of elevated risk and in highly contested operational environments.

3.1 Operational context

Within an offensive operation conducted by the Armored Brigade "N," as part of the mobile defence planned by Infantry Division "M," Mechanized Battalion "X" carries out decisive attack actions. To exploit the achieved tactical success, Tank Battalion "Y" (organic to the brigade) is committed to the operation in order to exploit the breach that has been created and maintain the operational tempo. During the engagement, the commander of Tank Company "Z" requests the urgent resupply of 160 rounds of 120 mm ammunition for the main tank guns, necessary to sustain the fire mission in support of the brigade's offensive operations.

Given the saturated hybrid operational environment - characterized by continuous attacks with both single and swarming drones, electromagnetic jamming, and intermittent artillery and missile strikes - the risk associated with conventional resupply convoys is significantly elevated. To mitigate these threats and ensure a rapid response, the decision is made to employ Unmanned Ground Vehicles (UGVs) organic to the Logistic Platoon (Log Plt) of the Logistics Company within Tank Battalion "Y" (Fig. 2). These UGVs are tasked to navigate through contested zones while countering the effects of electronic warfare and providing continuous ammunition support under high-threat conditions.

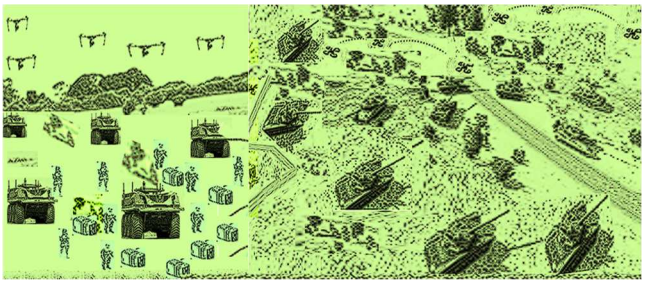


Fig. 2. UGVs, coordinated with surveillance and attack drones, execute the resupply of essential materials to the tank battalion's Combat Supply Point during offensive operations [8].

3.2 Methodological approach

This case study employs a tactical-level relational-operational analytical framework that combines deterministic quantitative modelling with system-of-systems analysis specific to logistics in highly contested environments. Unlike traditional linear replenishment models, this approach conceptualizes unmanned ground vehicles (UGVs) as components of a dynamic tactical logistics network, where logistical nodes, maneuver units, threat systems, and command-and-control structures interact continuously. The objective is to design and determine the operational employment of UGVs for on-demand resupply of 120 mm ammunition to a first-echelon tank company conducting offensive operations in a high-threat battlespace.

The model enables the assessment of UGV transport capacity under threat-constrained mobility conditions, relational dependencies between firing units, logistical nodes, and drone deployment points, the required number of resupply runs considering route variability and risk exposure, the duration of resupply cycles under contested conditions, mission survivability, operational resilience, and logistical redundancy, as well as the overall feasibility of drone-supported logistics in ISR-saturated and electronically contested environments.

The relational perspective highlights the interaction between logistical tempo and maneuver tempo, the link between route security and drone survivability, the dependence of resupply continuity on tactical decision cycles, and the balance between exposure time and logistical efficiency. Operational parameters are presented sequentially to ensure analytical coherence, reproducibility, and doctrinal applicability.

3.3 Data Required for Analysis

In order to substantiate the logistical calculations related to ammunition resupply during the offensive operation, a rigorous definition of the technical-tactical, logistical, and temporal parameters of the employed assets is required. For this purpose, the initial data were structured into functional categories, to enable a coherent, reproducible, and verifiable analysis. Within the methodological framework outlined above, the following input data are defined to support the quantitative modelling of the UGV-based ammunition resupply process. These parameters describe the organisational context, the technical characteristics of the transport UGVs and ammunition, as well as the spatial and temporal conditions under which the logistical missions are conducted:

a) At the Logistics Platoon / Logistics Company / Tank Battalion "Y" (Log Plt / Log Coy / Bn "Y" Tk), there are 7 UGVs, model "N".

b) The payload capacity of one UGV is q = 200 kg.

c) The weight of one 120 mm round is 15 kg.

d) The payload utilization coefficient of the UGV is C = 0,95.

e) The average round-trip distance covered by one UGV is l = 15 km, namely: l_1 = 13 km from the Log Plt / Log Coy / Bn "Y" Tk to the Combat Supply Point (CSP) / Tank Company "Z" (Tk Coy "Z") at Location 1; l_2 = 17 km from the Log Plt to the CSP/Tk Coy "Z" located at Location 2.

f) The total round-trip distance covered by one UGV is L = 30 km, representing the cumulative distance from the Log Plt to the CSP across both locations.

g) For each UGV, the following parameters are considered: an operational range of 10–30 km; an average tactical speed (Ats) of 30 km/h (maximum speed of 70 km/h is not considered); a loading time of 2 minutes; an unloading time of 2 minutes and 30 seconds; and an average travel distance of 15 km per resupply mission.

h) The probability of enemy attacks against logistics transport UGVs is as follows: a) low (10% of the equipment is put out of action); medium (35% of the equipment is put out of action); high (55% of the equipment is put out of action). The probability of occurrence of the three operational damage states on the logistics transport UGVs is: 0.25 (25%); 0.48 (48%); 0.27 (27%). In this situation, we determine the number of additional logistics transport UGVs required.

These parameters constitute the baseline assumptions of the case study and enable the application of the proposed calculation model. Based on these inputs, the subsequent requirements are formulated to assess transport capacity, temporal efficiency, and the operational feasibility of the UGV-based resupply solution, ensuring methodological transparency, computational reproducibility, and a sound basis for logistical decision-making [13].

3.4 Requirements

Based on the input parameters and methodological framework presented above, the following requirements have been defined to guide the quantitative assessment of the UGV-based ammunition resupply process. These requirements aim to determine the optimal allocation of resources, the number and duration of transport missions, and the overall operational feasibility of employing UGVs in a tactical offensive environment:

a) The number of transport missions (N_{TM}) conducted using UGVs, model "N;

b) The duration of a single ammunition transport mission using UGVs;

c) The total duration of all ammunition transport missions using UGVs;

d) The losses in logistic transport UGVs

3.5 Calculation and results

The following section presents the step-by-step solution of the case study, applying the quantitative deterministic methodology outlined above. Based on the defined input parameters, the calculations aim to determine the transport capacity of the UGVs, the number of resupply missions required, the duration of each mission, and the total time needed to complete the ammunition resupply process. This approach ensures methodological transparency, reproducibility of results, and a sound basis for assessing the operational feasibility of UGV - based logistical support in a tactical offensive scenario.

a) ***Determination of the number of transport runs (Tm) carried out with UGVs of model "N"***

$$Tm = \frac{Q_T}{Ntd \times C \times q} \qquad (1)$$

Where:

- ✓ Tm = number of transport runs executed with the specified drone;
- ✓ QT = total requirement of ammunition of a certain calibre for the unit;
- ✓ NTd = number of transport drones with a certain capacity;
- ✓ q = payload (carrying capacity) of a transport drone (in pieces or kg);
- ✓ C = coefficient of utilization of the drone's payload.

$$Tm = \frac{160}{7 \times 0,95 \times 12} = \frac{160}{79,8} = 2,005 \approx 2 \text{ transport missions.}$$

Explanation of the calculation:

The number of transport runs (Tm) is determined by dividing the total required quantity (Q_T = 160) by the effective transport capacity of the drones.

The effective capacity is calculated as the product of:

- ✓ the number of existing transport drones / UGVs (Ntd) = 7;
- ✓ the payload utilization coefficient (C) = 0,95;
- ✓ the payload of one drone (q) = 12, resulting from the calculation: 200 x 0,95 : 15 = 12,66 ≈ 12 tank gun projectiles (units)

b) *Determination of the duration of one ammunition transport trip* (Dt) *using UGVs*

The travel duration (Dt) of a UGV for one trip is determined using the formula:

$$Dt = \frac{Md}{Ams} = \frac{15\ \text{km}}{30\ \text{km/h}} = 0.5\ \text{h} \qquad (2)$$

The *total duration of one trip* (Dt) for a UGV is:

$$Dt = D_l + Td + D_u \qquad (3)$$

Where:

- ✓ Dt = duration of one ammunition; transport trip using UGVs;
- ✓ D_l = loading / preparation time;
- ✓ Td = travel duration;
- ✓ D_u = unloading time.

Thus, the total duration of one transport trip is:

Dt = 2 + 30 + 2 minutes and 30 seconds = 34, 5 minutes or 34 minutes and 30 seconds.

c) *Determination of the total duration* (DTt) *of ammunition transport runs using UGVs*

A total of 2 transport runs (Tm) are carried out. The total duration is calculated as:

$$DTt = Tm \times Dt \qquad (4)$$

$$DTt = 2 \times 34.5 = 69\ \text{minutes}$$

$$DTt = 1\ \text{hour}\ 9\ \text{minutes}$$

Explanation:

- ✓ 69 minutes = 1 hour and 9 minute;
- ✓ No remaining seconds, as 69 is a whole number of minutes.

d) *Determination of losses in logistic transport UGVs*

For this purpose, the following formula is used:

Details	**CONJUNCTURE**		
	Enemy attack probability on Log.Tp.UGVs		
	Low (**10%** of the equipment is removed from combat)	**Medium** (**35%** of the equipment is removed from combat)	**High** (**55%** of the equipment is removed from combat)
Determination of the remaining quantity to be transported and losses	Determinations for reducing the quantity to be transported (pcs.)		
	160 - (160 x 10/100) = 144	160 – (160 x 35/100) = 104	160 - (160 x 55/100) = 72
	Probability of achieving states of nature		
	0,25	0,48	0,27
	Remaining transportable (pcs.) = (144 x 0,25) + (104 x 0,48) + (72 x 0,27) = 36 + 49,92 + 19,44 = 105,36 ≈ **105** pcs.		
	Possible resulting losses (pcs.) = 160 - 105 = **55** pcs.		

Considering equation (1), it follows that Tm = 55 ÷ 79.8 = 0.689, which corresponds to an incomplete transport run, requiring approximately 5 additional drones (55 pcs ÷ 12 pcs/UGV = 4.58 ≈ 5 ground drones urgently provided from the upper echelon). In practice, this means that, within an additional 34 minutes and 30 seconds, a third logistical transport mission with UGVs will have to be carried out to meet the tactical operational requirement.

The use of autonomous vehicles (UGVs) in logistics transport enables the optimization of supply flow on the battlefield while reducing human exposure to risks.

The technical parameters of autonomous vehicles-such as payload capacity, operational range, and survivability under attack-can be integrated into operational planning to ensure

continuity of deliveries. Through simulations and risk analysis, the probability of losses can be assessed, and technical measures (modular design, armored protection, optimized routing) can be implemented to enhance the efficiency and reliability of logistics transport in high-intensity conflict scenarios.

4. DISCUSSION

Quantitative analysis of 120 mm ammunition resupply using unmanned ground vehicles (UGVs) highlights a paradigm shift in the relational design of tactical logistical support. Operational efficiency emerges not from the capacity of an individual platform alone, but from the coordinated, repeated operation within a distributed, networked system, ensuring a relatively constant logistical flow even under high-risk conditions.

The estimated total resupply duration (≈1 hour 9 minutes without losses; + 34 minutes 30 seconds if losses occur) reflects a direct relationship between required logistical mass, platform capacity, and transport distance.

This predictability allows optimisation either by increasing UGV numbers or by reducing distances between supply points and forward combat elements. Fragmenting deliveries into smaller, successive loads further reduces vulnerability, limits potential losses, and enables dynamic adaptation to actual ammunition consumption, enhancing network resilience while minimizing forward storage requirements.

Tactically, UGV deployment decouples personnel from direct exposure, increasing survivability while maintaining specialized human resources.

Within this relational framework, the value of these vehicles is measured not only by speed or payload, but by their contribution to continuous tactical operations, preservation of commanders' freedom of action, and the integrity of the tactical operational logistics network.

5. RESEARCH LIMITATIONS

The study is based on simplifying assumptions that limit the generalizability of its results in highly contested operational environments. It presumes stable and accessible routes, disregarding terrain degradation, tactical obstacles, or the need for evasive maneuvers, which in real scenarios could reduce UGV speeds and extend resupply durations, altering the interactions between transport platforms, forward units, and command-and-control nodes. The model also omits platform attrition from enemy fire, electronic warfare, or technical failures - factors that could disproportionately affect resupply times given the limited UGV inventory. Moreover, no sensitivity analysis addresses variations in the number of unmanned transport systems, while the study focuses solely on 120 mm ammunition transport, excluding competition with other critical supplies such as fuel, medical kits, or spare parts.

This isolation simplifies logistic interactions and does not fully capture the complexity and interdependence inherent in high-intensity operational sustainment.

6. CONCLUSIONS

From the above, the critical role of logistics transport UGVs in supporting tactical operations in operational environments characterized by high-intensity adversarial engagements becomes evident. The systematic analysis of key parameters-such as the number of transport missions, mission duration (both individual and cumulative), and incurred losses-demonstrates that autonomous tactical logistics networks can sustain resupply continuity and, consequently, the operational tempo, even under conditions of drone attacks, electronic warfare (jamming), or mobility constraints affecting conventional transport platforms.

The operational implementation is illustrated in Figures 1 and 2, which highlight the employment

of logistics transport UGVs within a hybrid tactical operating environment.

The autonomous execution of high-risk transport tasks ensures proper synchronization of logistics flows with the tempo of tactical maneuver, thereby enhancing operational resilience and the reliability of the force posture. The modular and distributed architecture of UGVs enables the simultaneous allocation and delivery of multiple classes of supply—such as individual combat rations, ammunition, medical supplies, fuel, and small-sized equipment—within the same operational framework.

Each UGV operates independently, providing redundancy and ensuring continuity of the autonomous transport system. The loss of a ground transport UGV or the malfunction of another does not compromise the overall network's ability to deliver critical resources; thus, the integrity of the supply chain and operational continuity are preserved even in complex tactical environments characterized by high-intensity adversarial engagements.

The research findings indicate that logistics transport UGVs constitute a flexible and effective asset for the S4 logistics function, providing rapid and adaptable decision-support capabilities for planning and scheduling resupply missions involving critical materiel through the application of "push" and "pull" logistics principles.

The capability of these platforms to operate autonomously and in synchronization with the tempo of maneuver ensures operational resilience and continuity of the supply chain, including for forward-deployed tactical units operating in isolation or with limited mobility for operational security purposes.

Therefore, the integration of autonomous ground systems to enable Just-in-Time logistics in tactical operations enhances the adaptability, robustness, and operational relevance of present and future military logistics, enabling resource optimization, reducing risks to personnel, and ensuring effectiveness in meeting the demands of the future battlefield.

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Abordări relaționale privind proiectarea utilizării dronelor logistice terestre de transport în medii operaționale tactice puternic contestate

Rezumat: Conflictul din Ucraina a evidențiat medii de luptă hibride, cu atacuri continue folosind drone, roiuri de drone, artilerie, rachete și bruiaj electromagnetic, exercitând presiune asupra susținerii operațiunilor unităților tactice. Pentru a sprijini structurile de luptă, Vehiculele Terestre Fără Pilot (UGV) sunt analizate și utilizate tot mai mult pentru transportul muniției, echipamentelor ușoare și proviziilor în zone intens contestate. Prin acest articol nu urmărim dezvoltarea tehnologică a dronelor, ci utilizarea lor eficientă pentru reaprovizionarea promptă la cerere, concentrându-ne pe proiectări cantitative și deterministice în condițiile tactice menționate pentru muniția de 120 mm. Printr-un model metodologic bazat pe date ipotetice, am determinat transportul optim pe curse de transport, perioada uneia și durata misiunii, luând în considerare pierderile posibile și protecția împotriva atacurilor, crescând reziliența logistică și reducând expunerea personalului.

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