

A LOW-COST ALTERNATIVE TO EXPENSIVE MISSILES: THE TACTICAL AND ECONOMIC EFFICIENCY OF MOBILE FIRE GROUPS

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Abstract

This article examines the role of Mobile Fire Groups (MFGs) in modern air defense systems in countering Shahed/Geran-type kamikaze drones. Based on open-source data and field experience, conclusions are drawn regarding the economic and tactical efficiency of using light anti-aircraft weapons and heavy machine guns as an alternative to costly surface-to-air missiles.

Keywords: Mobile fire groups, Shahed/Geran drones, surface-to-air missile system, air defense, economic efficiency, heavy machine gun.

Introduction

QIMMATBAHO RAKETALARGA ARZON MUQOBIL: MOBIL O‘T OCHISH GURUHLARINING TAKTIK VA IQTISODIY SAMARADORLIGI

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ДЕШЁВАЯ АЛЬТЕРНАТИВА ДОРОГИМ РАКЕТАМ: ТАКТИЧЕСКАЯ И ЭКОНОМИЧЕСКАЯ ЭФФЕКТИВНОСТЬ МОБИЛЬНЫХ ОГНЕВЫХ ГРУПП

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Annotatsiya:

Ushbu maqolada zamonaviy havo hujumidan mudofaa tizimida “Shahed/Geran” tipidagi kamikadze-dronlarga qarshi kurashda mobil o‘t ochish guruhlarining (MO‘G) o‘rni tahlil qilinadi. Qimmat zenit raketalari o‘rniga engil zenit qurollari va yirik kalibrli pulyometlardan foydalanish orqali erishilgan iqtisodiy tejamkorlik va taktik samaradorlik ko‘rsatkichlari asosida xulosalar chiqariladi. Maqola ochiq manbalarda e‘lon qilingan tajriba va statistik ma‘lumotlarga tayanadi.

Kalit so‘zlar: mobil o‘t ochish guruhlari, Shahed/Geran dronlari, zenit raketa majmuasi, havo hujumidan mudofaa, iqtisodiy samaradorlik, yirik kalibrli pulyomyot.

Аннотация:

В статье анализируется роль мобильных огневых групп (МОГ) в современной системе противовоздушной обороны в борьбе с дронами-камикадзе типа «Шахед/Герань». На основе открытых данных и практического опыта делаются выводы об экономической и тактической эффективности применения лёгких зенитных средств и крупнокалиберных пулемётов вместо дорогостоящих зенитных ракет.

Ключевые слова: мобильные огневые группы, дроны Шахед/Герань, зенитно-ракетный комплекс, противовоздушная оборона, экономическая эффективность, крупнокалиберный пулемёт.

In recent years, a new type of threat to air defense systems has emerged in the Russia-Ukraine conflict: inexpensive yet mass-deployed kamikaze drones. The Iranian-made "Shahed-136" and its Russian counterpart, the "Geran-2," are being launched in the dozens—or even hundreds—during nightly attacks. Under these circumstances, the use of traditional surface-to-air missile systems, while technically effective, imposes an unjustifiable economic burden. A single modern interceptor missile costs tens or sometimes hundreds of thousands of dollars, whereas the cost of one "Shahed" drone is estimated at approximately \$20,000 to \$50,000.

Consequently, the issue of "using an expensive asset against a low-cost target" is being widely discussed among military experts [1].

To address this economic and tactical imbalance, mobile fire groups (MFGs) have begun to be widely deployed as a lower-echelon asset. MFGs are rapid-response military units designed to destroy low-altitude targets; they are equipped with large-caliber machine guns (such as the Browning M2, DShK, and KPVT) or small-caliber anti-aircraft guns (such as the ZU-23-2) mounted on highly mobile vehicles.

Relevance of the issue. Modern air defense systems consist of several echelons: long-range surface-to-air missile systems, medium-range systems, electronic warfare (EW) assets, interceptor drones, and the lower echelon—mobile firing groups. Each echelon performs a specific function, yet it is the lower echelon that bears the brunt of mass drone attacks, as the resources of the upper echelons are limited and best reserved for protecting the most critical assets [2]. When faced with the simultaneous arrival of hundreds of drones, expending an expensive missile on each target is economically and logistically unfeasible. This is precisely where loitering munitions become crucial: they utilize inexpensive ammunition, and the cost of a single salvo does not exceed a few tens of dollars.

The organizational and tactical structure of mobile fire groups must be maximally flexible and mobile. They are specifically formed to deliver rapid and cost-effective strikes against modern asymmetric threats—particularly kamikaze drones flying at low altitudes and in zones undetectable by radar stations [2].

The composition of standard mobile fire teams consists of the following equipment and combat elements:

vehicle – a high-mobility pickup truck (e.g., Toyota Hilux, Mitsubishi L200) or a light armored vehicle capable of traversing off-road and complex terrain [3]. These vehicles enable the group to reposition within seconds to align with the target and to rapidly depart the location after firing [2];

firepower assets – 12.7 mm (Browning M2, DShK) or 14.5 mm caliber (KPVT) heavy machine guns, as well as, in some cases, 23 mm ZU-23-2 automatic anti-aircraft mounts [3]. These weapons enable high-density fire against small, low-altitude targets [5];

opto-electronic and surveillance equipment – thermal (thermal imaging) and night-vision sights, laser rangefinders, and high-power infrared/visible floodlights for the visual identification of targets under night and adverse weather conditions [3];

digital communication and analysis system – early-warning digital radar, as well as specialized combat tablets and secure digital communication devices connected in real time to a network of acoustic sensors deployed across the country [3,6].

The tactical movement of mobile firing groups relies primarily on data from acoustic and radar reconnaissance. Once the drone's flight trajectory and direction are determined, the group rapidly occupies a favorable firing position along the probable flight path. When the target approaches within a range of 1.5–2 km, precise fire is directed at it using optoelectronic and thermal imaging devices [3]. Observations indicate that a precise hit to a drone's engine or wing causes it to crash. In such cases, firing effectiveness can reach 70–85% at ranges of up to 2 km, though this figure varies depending on weather conditions, the drone's altitude, and the operator's experience. The cost of a single salvo is just a few dollars—a figure demonstrating that this method is thousands of times cheaper than using anti-aircraft missiles.

Analysis of economic efficiency. From an economic perspective, the advantage of the large-caliber machine gun (LCMG) lies in the fact that the cost of a single anti-aircraft missile is equivalent to the price of thousands of machine gun rounds. While a single missile for a modern anti-aircraft system costs an average of \$100,000–\$150,000, the price of a large-caliber machine gun round does not exceed a few dollars. Consequently, even if the LCMG's ammunition consumption is high (requiring several dozen rounds to destroy a single drone), the total cost remains hundreds of times lower than that of an anti-aircraft missile [4]. Furthermore, establishing mobile fire teams does not require complex infrastructure, radar stations, or centralized control systems, allowing for rapid deployment and cost-effective scaling. A unit consisting of a few pickup trucks, machine guns, and trained personnel can be organized in any area, enabling the defense line to be extended across a vast geographical expanse.

Comparative analysis of the performance indicators of the Zenit missile system and mobile fire groups:

Indicator	Surface-to-air missile system (SAMS) [1]	Mobile fire team (MFT) [4]
Price of a single neutralization unit	\$1,200,000 – \$3,500,000 (rocket price) [1]	\$100 – \$500 (cost of ammunition) [4]
Target distance/height	15 km–150 km / up to 20 km [2]	1.5 km–2.5 km/up to 1.5 km [5]
Mobility and spreading time	10–30 minutes (high/medium) [2]	1–3 minutes (very high) [3]
Economic ratio (impact/cost)	Extremely high-cost [1]	Highly cost-effective [4]

This comparative analysis demonstrates that the primary tactical advantage of mobile fire groups lies in their exceptional mobility and cost-effectiveness [4]. They enable the conservation of the costly resources (missiles) of strategic surface-to-air missile systems, allowing those systems to be dedicated solely to protecting critical state facilities and high-altitude targets [2].

Ensuring the economic sustainability of air defense (AD) systems in the context of asymmetric military conflicts is a top priority [1]. Economic analyses indicate that the cost of ammunition and maintenance incurred by mobile fire groups (MFGs) to destroy a single "Shahed-136" or "Geran-2" type kamikaze drone averages between 100 and 500 US dollars [2,4]. Even if 200–300 rounds of 12.7 mm or 14.5 mm large-caliber ammunition are expended to successfully shoot down a single drone, the resulting cost efficiency is more than 1,000 times greater than that of employing strategic surface-to-air missile (SAM) systems [3,4]. Given that the cost of a single modern anti-aircraft missile ranges from 1.2 to 3.5 million dollars, while the target itself is valued at approximately 20,000–50,000 dollars, the use of such missiles leads to a disproportionate expenditure of strategic resources [1,4]. Consequently, the use of mobile fire groups represents the most effective method for preserving the state's military-economic resources and stockpiles of expensive missiles [2,3].

However, in modern warfare, changes in enemy tactics and technologies are also giving rise to a number of significant limitations regarding the tactical capabilities of mobile fire groups.

Altitude limitations and engagement effectiveness: when enemy kamikaze drones increase their flight altitude to 2,500–4,000 meters, the effective firing range of ground-based large-caliber machine guns (DShK, Browning M2) and standard automatic anti-aircraft guns proves insufficient [3, 5]. When drones shift to high-altitude tactics, the direct engagement effectiveness of MOBILE FIRE GROUPS drops to 20–30% [1, 5].

Impact of adverse weather and visibility conditions: the operation of optical, visual, and optoelectronic surveillance systems is significantly hampered by conditions such as dense fog, heavy rain, snow, and low cloud cover [2]. At night, relying solely on a searchlight or a standard thermal imager reduces the likelihood of successfully engaging rapidly maneuvering targets [3, 5].

The issue of the safety of populated areas and infrastructure: large-caliber rounds (12.7 mm, 14.5 mm) fired indiscriminately over densely populated cities and infrastructure facilities can ricochet and fall back to the ground, posing a risk of accidental physical harm to civilians and material damage to residential buildings and structures [2, 6].

Navigation and tactical shifts—specifically the transition of drones to autonomous inertial and optical navigation systems resistant to electronic warfare (EW) countermeasures—are enabling them to fly along unpredictable routes [5,6]. This situation requires mobile firing groups to achieve deeper integration with acoustic and radar networks and to rapidly relocate their firing positions [3,6].

Combat experience confirms the necessity of gradually equipping mobile fire groups with FPV interceptors (interceptor drones) and small-caliber automatic anti-aircraft systems featuring programmable air-burst capabilities to overcome these tactical limitations [3, 5].

Role within the multi-echelon defense system. Mobile fire groups do not operate as isolated, independent assets within modern air defense systems; rather, they function effectively as the most flexible component of a multi-layered (echeloned) and integrated defense [1, 6]. Individual assets fail to yield the expected results when countering massive and intense enemy drone attacks; therefore, a successful defense model requires the following systemic and echeloned integration [2, 6]:

First echelon (long-range radar stations and electronic warfare systems): early detection and tracking of drones at long ranges (100–300 km), as well as the disruption of enemy targets' satellite and autonomous navigation systems (GPS, GLONASS) using long-range electronic warfare (EW) assets [1, 6].

Second echelon (aviation and interceptor drones) – the destruction of medium- and high-altitude (1,500–4,000 m) targets before they reach strategic facilities, utilizing fighter aircraft, helicopters, and specialized FPV interceptors (interceptor drones) [3, 5].

Third echelon (small-caliber automatic anti-aircraft systems): automatic anti-aircraft systems—such as "Gepard," "Skynex," "C-RAM," and the upgraded ZU-23-

2—that feature dedicated radar and opto-electronic control systems and provide a high rate of fire [2, 5].

The fourth echelon (mobile firing groups)—mobile units armed with large-caliber machine guns (12.7 mm, 14.5 mm) and thermal imagers—destroys drones flying at low altitudes (up to 1,500 m) and within radar "blind zones" during the final and immediate approach stages [3, 4].

Practical experience and combat statistics indicate that, during massive drone attacks, the coordinated action of all echelons within a unified digital command-and-control network results in the successful destruction of 85–95% of targets before they reach the defended assets [1, 6].

CONCLUSION

Observations indicate that mobile fire groups constitute a vital, though not exclusive, component of modern air defense systems. Their primary advantages include low cost, rapid deployability, and the ability to conserve expensive anti-aircraft missiles for the protection of key strategic assets. However, the effectiveness of mobile fire groups may diminish over time as the enemy alters drone flight altitudes and routes, necessitating continuous improvement.

PROPOSALS

Widespread integration of modern thermal and night-vision devices into mobile fire groups, which enhances their effectiveness against night attacks;
integrating the units with acoustic and radar early warning systems to reduce reaction time;
supplementing mobile fire groups (MFGs) with small-caliber automatic anti-aircraft guns (such as the Gepard) to counter high-altitude drones;
reducing ammunition consumption and increasing effectiveness through regular personnel training and the refinement of firing techniques;
clearly defining firing sectors and strengthening measures to prevent collateral damage in order to ensure public safety;
formalizing the role of MFGs as an integral part of the multi-layered defense system and ensuring their coordinated operation with other assets (electronic warfare systems, interceptor drones, and aviation).

REFERENCES

1. Бескрестнов С. «Флеш». Мобильные группы ПВО потеряли эффективность: эксперт сказал, чем теперь сбивают «Шахеды» [Elektron manba]. - УНИАН, 2025. Manba havolasi: <https://www.unian.net/weapons/voyna-v-ukraine-drony-shahed-teper-sbivat-znachitelno-trudnee-govoryat-eksperty-13055745.html>
2. Петренко О. В Украине критикуют мобильные группы ПВО - в России копируют опыт: какова на самом деле эффективность МОГ [Elektron manba]. - Фокус, 2026. Manba havolasi: <https://focus.ua/eksklyuzivnyy/728546-effektivnost-mobilnyh-ognevyh-grupp-skolko-na-samom-dele-sbivayut-shahedov>
3. Елизаров П. Дроны-перехватчики - в ВС назвали статистику сбитых «Шахедов» [Elektron manba]. - ТСН, 2026. Manba havolasi: <https://tsn.ua/ru/ato/170-ekipazhey-vs-za-god-ne-sbili-ni-odnogo-shaheda-elizarov-shokiroval-statistikoy-3073076.html>
4. Редакция. Угрожает ли Украине еще большее количество российских «Шахедов» [Elektron manba]. - Новости Донбасса, 2025. Manba havolasi: <https://novosti.dn.ua/ru/article/9796-smozhet-li-rossiya-zapuskat-tysyachi-shahedov-kazhduyu-noch>
5. Редакция. Чем сбивают «Шахеды»: как Украина уничтожает иранские дроны и «Герань-2» [Elektron manba]. - El-conf.com.ua, 2026. Manba havolasi: <https://el-conf.com.ua/ru/chym-zbyvayut-shahedy/>
6. Редакция. Чем сбивают «Шахеды»: полный гид по методам противодействия [Elektron manba]. - Хвиля Києва, 2026. Manba havolasi: <https://flakyiv.org.ua/ru/chym-zbyvaiut-shakhedy-povnyi-hid-po-metodakh-protydii/>