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Lessons to be learned from the Nagorno-Karabah conflict

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Abstract

The new threats of modern warfare compel the thinking and development of a credible air defense capability based on early warning systems, surface-to-air missiles, fighter aircraft and associated command and control systems. Ground-based air defence, largely neglected in the air campaigns that dominated the last years of military conflicts, where the air threat was quite low, is once again examined by military analysts. The combatants involved in the 2020 Nagorno-Karabakh conflict are responsible for this.

Keywords:
Nagorno-Karabakh; air defence; drone; ground-based air defence; surface-to-air missiles; anti-aircraft artillery; GBAD systems; unmanned aircraft systems.

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The war between Armenia and Azerbaijan for the control of the Nagorno-Karabakh region, which took place between September 27 and November 10, 2020, is currently returning as a benchmark for any potential conflict on the world map, in view of the decisive role of drones and the low efficiency of measures to combat them. The conflict took place between two countries whose lack or insufficiency of air assets had to be quickly compensated and managed in order to attract the attention of military specialists by the unique way in which unmanned aircraft systems were used in aerial reconnaissance, strike or neutralization missions, missions that used to be specific to the military aircraft.

The asymmetric threats generated by the use of *Unmanned Aircraft Systems*/ UAS, popularly known as *drones*[1], which are becoming increasingly present in the arsenal of many states, require a regaining of the relevance of ground-based air defense structures/GBAD in combating them. Looking at factors such as quantity, availability, cost or influence of weather conditions, we find that GBAD structures are much better suited to combat these threats than fighter aircraft.

The Nagorno-Karabakh conflict has provided, and still provides, enough analysis, lessons and experiences for military planners, regardless of country or color of uniform, to ensure the use of air defence systems in an integrated and effective manner against non-conventional air challenges, that exist or may arise in the near future. It is possible that some lessons learned from this conflict are not so innovative, or that others have already been implemented at the level of states with strong development in the field, where the concept of integrated air defence is understood and applied, and the capability inventory contains sufficient systems that can combat or neutralize unmanned aircraft systems. However, their existence and use on an ever-increasing scale is and, logically, will be a critical problem for any air defence.

The reality of the battlefield has demonstrated that the threat posed by the use of UAS is not singular. Air defence challenges start with *classic* aircraft, to which there must be added the *ubiquitous* UAS/drones, the *familiar* ballistic or cruise missiles and the *new* hypersonic missiles.
The purpose of the article is to show the importance of air defense during the Nagorno-Karabakh conflict and to bring to the fore a series of observations, in the form of identified lessons, that can help to better understand the consequences of the conflict and contribute to the effectiveness of using air defence in actions to counter UAS.

Why Unmanned Aircraft Systems?

The ability of air power to influence the planning and conduct of joint operations has led to its definition as representing "*the ability to use air*

[1] N.A.: In the military field, the term used is *unmanned aircraft system/UAS*, while the term *drone* is predominantly used and widely accepted in the civilian field for all types of unmanned systems, commercial or military. Under these circumstances, the two names will be used interchangeably throughout the article, because the information is taken from military sources, free to publish, or from various articles, publications or websites. For more details, you can consult *A Comprehensive Approach to Countering Unmanned Aircraft Systems*, a study developed by the Joint Air Power Competence Center.

capabilities to influence the behavior of actors and the course of events" (NATO Standardization Office 2016, 1-2). However, air power represents more than the operational capability of a country's air forces and must be seen as a compound of specific equipment, factors and systems, more or less tangible, but equally important, of which no defence industry, research and education in the field, mindset, doctrinal development, characteristic infrastructure and leadership commensurate with requirements and ambitions must be lacking. Adding to this the power to adapt to the challenges of the operating environment, the proficiency of the users, the daring in execution and the practical combat experience, it can thus be explained why some air forces are simply better and more effective in combat than others.

In the absence of an efficient, robust and resource-consuming air power, the states tried to augment, or more correctly said, supplement it with a series of equipment that could replace, to the greatest extent possible, the combat aircraft. The most accessible solutions have turned out to be unmanned aircraft systems/UAS or drones. The cost-effectiveness ratio in favor of UAS makes their use increasingly common in future conflicts, especially for states that do not have a well-developed air power component (the aviation component being the best example). This approach to air warfare by Azerbaijan in the Nagorno-Karabakh conflict amply proved this.

Considering what has been presented, however, a brief clarification is necessary. The attraction for unmanned aircraft systems is well known due to a number of operational and technical advantages. Eliminating the vulnerability of crews, their command and control is carried out from outside the combat space, production and personnel costs are greatly reduced compared to manned aircraft (while the production rate is high), flight duration and range have a permanently increasing trend, use in increasingly complex missions, or use by all categories of forces are the advantages that recommend their purchase. At the same time, a series of disadvantages related to the use of air space, the reduction or elimination of the involvement of the human factor at the place of action, the dependence on satellite communication systems, increased vulnerability in the event of discovery by GBAD systems must also be taken into account.

However, the use of drones has shifted the balance of power in a war that has placed two state actors against each other. Bayraktar, Turkish drones, along with other Israeli weapon systems acquired by Azerbaijan in recent years, have categorically counterbalanced the advantage of Armenia's ground forces. Since neither country had a sufficiently developed air power, and most of the fighting took place on the ground, having high-performance drone systems made the difference between victory and failure.

It should also not be omitted the fact that unmanned aircraft systems, which have proven to be able to perform some of the missions of tactical aviation or of

correcting the fire of artillery systems, may become favorites for countries that cannot afford modern and expensive weaponry. The same situation can also be found in countries that own aircraft of different origins (East-West) and generations, some of which are outdated both physically and morally. It is thus quite obvious that unmanned aircraft systems can provide the advantage of air power through the possibilities of use, at a much lower price, compared to the costs of manned aircraft. At the same time, the spread of UAS, through the prism of the advantages presented, will surpass that of air defense systems and accelerate the elimination of obsolete systems.

Gaining a degree of control of the air remains, *in the future*, a desire of the modern conflict. The fact that the opponent, the alliance with Turkey, the terrain and the weather conditions allowed Azerbaijan to achieve this by much less expensive methods, is just another face of this conflict.

What must be considered in solving the *manned aircraft or UAS* alternative is the(further) need to ensure a degree of control of the air, because "*command of the air will remain a prerequisite for all operations, with or without aircrew*" (Mason 2014, 228). As the air power theorist John A. Warden III observed, since the German attack on Poland in 1939, "*no country has won a war in the face of enemy air superiority, no major offensive has succeeded against an opponent who controlled the air, and no defence has sustained itself against an enemy who had air superiority* " (Warden 1988, 13).

Missiles, drones and artillery

Armenia's missile arsenal at the start of the conflict[2] consisted entirely of missiles of Soviet or Russian origin, through the inheritance of Tochka and Scud missiles from the Soviet Union and purchase of Iskander missiles from Russia in 2016. Armenia's drone fleet consisted of small-scale indigenous systems, whose main mission was reconnaissance (Shaikh and Rumbaugh 2020). During the 44 days of the conflict, the Armenian unmanned aircraft systems proved inferior to the Israeli or Turkish models purchased by the Azerbaijanis, thus unable to replace the role of military aviation.

On the other hand, Azerbaijan possessed a more diverse and modern arsenal of missiles, artillery and drones. Apart from the systems and equipment of ex-Soviet or Russian origin, the Azerbaijanis have acquired other, much more effective systems (one such example being the short-range ballistic missile – LORA). In terms of drone inventory, Azerbaijan has developed and completed an impressive arsenal of UAS: Turkey's Bayraktar TB2 and

[2] N.A.: As a rough guide of the military forces of the two countries can be obtained at Michael Kofman, Leonid Nersisyan, *The second Nagorno-Karabakh War, two weeks in,* War on the Rocks, URL: https://warontherocks.com/2020/10/the-second-nagorno-karabakh-war-two-weeks-in/, accessed 09/02/2021 and Shaan Shaikh, Wes Rumbaugh, *The Air and Missile War in Nagorno-Karabakh: Lessons for the Future of Strike and Defense*, Center for Strategic & International Studies, URL: https://www.csis.org/analysis/air-and-missile-war-nagorno-karabakh-lessons-future-strike-and-defense, accessed on 09.09.2021

numerous Israeli *loitering munitions*[3] known as *kamikaze drones*, including Harop[4], Orbiter and SkyStriker UAVs (Shaikh and Rumbaugh 2020).

Even though Azerbaijan had an undoubted advantage in terms of the number of combat aircraft and helicopters, which were little used in the conflict, both countries had ground-based air defense systems that, could theoretically be responsible for heavy losses among manned aircraft (Kofman and Nersisyan 2020). A surprising element was the conversion of old Antonov An-2 aircraft, a versatile single-engine biplane, to be used as single-use drones (Kofman and Nersisyan 2020), mainly for locating ground-based air defenses.

The robustness and consistency of the fleet of unmanned aircraft systems of the Azerbaijan Air Force is also evident from the information presented by *Jane's World Air Forces* and taken by the *Military Review* (Lt. Col.Erickson 2021, 4)[5]:

- thirty-six Bayraktar TB2 unmanned aircraft systems, armed with Roketsan MAM-L laser-guided munitions;
- forty-eight Israeli HAROP loitering munitions;
- a large number of Israeli Orbiter 1K loitering munitions, Elbit Hermes 450/900, SkyStriker and Aerostar UAs.

Azerbaijan's conversion of old Russian An-2 biplanes into drones was a novel approach, as their low-altitude flight revealed the positions of ground-based air defence structures, thus providing targets for Turkish drones (Hambling 2020). Using this tactic allowed the Azerbaijanis to destroy/disable the vast majority of Armenian air and missile defense systems and achieve tactical air superiority, with minimal risk to their own forces. This tactic is not exactly new, it is reminiscent of the *Wild Weasel* or *Hunter-Killer* concepts of the Vietnam era, where a bait aircraft would fly at low altitude in an attempt to force air defenses to open fire, so that another aircraft could engage exposed enemies (Thomas, et al. 2021).

The priority that the two countries gave to military development and modernization was reflected in the differences identified by military analysts at the beginning, and especially during the conflict. Thus, a SIPRI analysis (Wezeman, Kuimova and Smith 2021) showed that:

- in 2020, Armenia's military expenditures represented 4.9% of its gross domestic product (GDP), and Azerbaijan's represented 5.4%;
- military spending levels differed significantly between the two countries: Armenia spent in 2020 $634 million, while Azerbaijan, in the same year, spent $2,238 million;
- because neither country has a significant arms industry, both of them relied on external suppliers to expand, complement or develop their arsenals. The analysis of imports shows that they were asymmetric:

[3] N.A.: More details on loitering munitions can be found at https://dronecenter.bard.edu/loitering-munitions-in-focus/

[4] N.A.: A description of the HAROP system can be viewed at https://www.airforce-technology.com/projects/haroploiteringmuniti/

[5] ***, Azerbaijan, Air Force, in Jane's World Air Forces (Coulsdon, UK: Janes, 10 December 2020), 11–12, APUD Lt. Col. Edward J. Erickson, *Nagorno-Karabakh, Turkish Drone Success or Operational Art,* Military Review, Army University Press, URL: https://www.armyupress.army.mil/Journals/Military-Review/Online-Exclusive/2021-OLE/Erickson/, accessed on 06.01.2022.

in the period 2011–2020, the volume of Azerbaijan' arms imports is estimated by SIPRI to be 8.2 times higher than that of Armenia.

Lessons Identified:

1. Establishing an inventory of forces and capabilities (to be prepared, acquired or developed) necessary to fulfill the established objectives or the perspective configuration of the armed forces;

2. The clear establishment of military priorities and the identification of that cooperation partner to support the modernization effort of the armed forces;

3. Development of new air defense concepts, doctrines and strategies to respond to threats generated by the use of UAS.

Implications for modern warfare/future conflicts

The existence of UAS in a country's inventory and their smart use provides a viable alternative to compensate for the poor effectiveness of manned aircraft. In the case of equal combatants in terms of military power, the orientation towards the acquisition and use of UAS provides an asymmetric advantage, which can be reflected in:

- targeting support;
- multiplying the effects by executing SEAD[6] missions, considering that a GBAD system cannot counter every air threat;
- increasing the research distance in proportion to maintaining a low risk level.

[6] Suppression of Enemy Air Defenses

The support of the Azerbaijani armed forces with unmanned aircraft systems was an important element in achieving the operational objectives set at military campaign level. Using a different flight profile than manned aircraft, difficult to detect by radar stations, UAS helped to exploit the vulnerabilities of the systems that provided their early warning and combat. The design of Azerbaijan's campaign ensured harmony between the campaign's objectives (the operational objectives set at the joint level), the ways of achieving the objectives and the means used[7].

[7] N.A: A well-argued view of Azeri campaign planning is provided by Lt. Col. Edward J. Erickson in *Nagorno-Karabakh, Turkish Drone Success or Operational Art?,* Military Review, URL: https://www.armyupress.army.mil/Journals/Military-Review/Online-Exclusive/2021-OLE/Erickson/, accessed on 03.09.2021

On the first day of the Azeri offensive (27.09.2020), unmanned aircraft systems targeted Armenia's mobile short-range air defense systems (OSA/SA-8 and STRELA-10/SA-13), the systems' launchers S-300/SA-10 and KUB/SA-6 and long-range air defence systems radars (Roblin 2020). Their neutralization created the conditions for the full use of the entire UAS fleet. The equipment at the disposal of the Armenians was slightly used in combating air threats, the S-300 system, along with other systems manufactured in the 1970s and 1980s, proving ineffective against ballistic missiles and small UAS. Armenia's

recently acquired Russian Su-30 fighter jets, the most advanced in its air force, were not used in the conflict. This, coupled with the inability of Armenian air defence systems to counter Azeri UAS, allowed Azerbaijan to dominate the airspace and effectively engage opposing ground forces.

Overall, in the absence of a solid air defense architecture and in relatively permissive airspaces, drones have proven effective in SEAD-type missions (Kasapoglu 2020), *still considered* to be the responsibility of aircraft dedicated to such missions. SEAD operations conducted with UAS are ideal against those adversaries that do not have a layered air defence, supported by a command-and-control system to provide early warning, air picture of the battlefield or deconfliction of complex defence situations.

Azerbaijan's use of drones has proven to be a tactical success, although there are numerous examples in recent history of the devastating force of air power against a ground force with poor air defenses. The use of unmanned aircraft systems represents in this case rather a natural evolution of the use of air power than a revolution of it, as was warmly appreciated during the conflict. There is an ongoing concern for military analysts to identify lessons from contemporary conflicts, especially when new or modern weapon systems are used. At the same time, there is the danger of hasty generalizations starting from the study of isolated or poorly representative cases. The conclusion that in the future only unmanned aircraft systems will be used does not have a solid basis, given that the future combatants will approach the possibilities and vulnerabilities of new systems much more sharply. It is also unlikely that the exclusive use of UAS can provide adequate solutions against an experienced adversary with A2/AD[8] capabilities supported by electronic warfare and anti-drone systems (Kasapoglu 2020).

Lessons Identified:

4. Acquisition or development of integrated SHORAD /VSHORAD[9] systems or revitalization of anti-aircraft artillery systems;

5. The integration of all air defense capabilities into a layered, balanced and robust system that ensures the assigned defence missions;

6. The development of technologies that can solve the problem of continuous detection and tracking of UAS, given the smaller and smaller dimensions and the characteristics of the manufacturing materials (plastic or composite materials).

Open-source reports suggested that the drones helped to disable a large number of Armenian tanks, combat vehicles, artillery units and air defense systems. Their use also contributed to the disorganization of the supply and logistics system of the Armenian troops, which was the basis of the subsequent successes of the Azeris (Shaikh and Rumbaugh 2020)[10]. However, it should be noted that damage attributed to drones in this conflict has provoked,

[8] Anti-Access/ Area-Denial.

[9] SHORAD /VSHORAD - SHort Range Air Defense /Very SHort Range Air Defense.

[10] N.A: Shaan Shaikh și Wes Rumbaugh refer to The Fight For Nagorno-Karabakh: Documenting Losses On The Sides Of Armenia And Azerbaijan - Oryx (oryxspioenkop.com), where the authors, Stijn Mitzer and Joost Oliemans, present a detailed list (justified by photo and video captures) of vehicles destroyed and captured by the two countries involved in the conflict.

and continues to provoke heated debate, with many of the estimates likely to be exaggerated. An eloquent example of this is a Sputnik report in the Azerbaijani language, from which it follows that the number of tanks destroyed by drones is greater than the total number of tanks owned by Armenia (Gressel 2020).

While ground-based air defence is increasingly subject to criticism regarding the difficulty of combating UAS (the conflicts in Syria and Nagorno-Karabakh and more recently in Ukraine being the most conclusive), there must not be forgotten the context, the generation of GBAD systems, their mode of operation and their role in the overall military campaign. The first lesson learned from the Azerbaijani-Armenian clashes is "*the vulnerability of traditional ground units – armored, mechanized and motorized formations, in front of advanced drone combat concepts and capabilities*," said Can Kasapoglu, Director of Security and Defense Studies Program at EDAM (Center for Economics and Foreign Policy Studies, Istanbul)[11]. If the inherent vulnerabilities of some systems are something that can be accepted within certain limits, the lack of their protection to prevent their exploitation by the adversary is unthinkable.

Equally, it should not be overlooked that UAS are not invincible, with Turkey losing many of its TB2 drones in the Syrian conflict. An important aspect that should not be neglected is the fact that, when the Armenian ground units had no longer air defence provided by the air defense systems made available, the losses were considerable. Thus, Armenia's loss in the first days of the conflict of 84 tanks, along with numerous multiple launch rocket and artillery systems, compared to only 13 to 15 ground-based air defence systems, suggests an availability rather low of air defence relative to the size of the armored force (Kofman and Nersisyan 2020).

The need for air defence of the surface forces is a commitment for all military leaders, and achieving an advantageous ratio between the units to be defended and those providing the defense is the way to achieve it. Needless to say that a ground force lacking air defence is inherently vulnerable. In a situation where air threats are more and more serious and air protection is more and more difficult to achieve, the lack of it is simply an invitation to disaster.

Lessons Identified:

> *7. Obey and employ the specific principles of using ground-based air defense in operations. Particularly for this situation, massing, mixing and mobility*[12] *are the most important principles that were not, or could not be applied. The application of these principles must be correlated with the technical and tactical possibilities of each weapon and sensor system and the relevant factors regarding the mission received, the adversary and the operating environment, the support provided and the time available, the particularities of the troops and the objectives to be defended in relation to the priorities of the defence structures with the ground base involved.*

[11] ***, Ron Synovitz, Andrei Luca Popescu, „Tehnologie, comando și Turcia. Cum a câștigat Azerbaidjan în Nagorno-Karabah", URL: https://romania.europalibera.org/a/analiza-tehnologie-comando-turcia-azerbaidjan-nagorno-karabah/30950259.html, accessed on 06.01.2022

[12] N.A: The principles of ground-based air defense are: mass, mix, mobility, integration, flexibility, and agility. These are detailed in *FM 3-01, U.S. Army Air and Missile Defense Operations*, Department of the Army, Washington, D.C., 22 December 2020, pp. 1-4÷1-6, URL: https://armypubs.army.mil/ProductMaps/PubForm/Details.aspx?PUB_ID=1021420

It is possible that after this conflict there will be voices proclaiming the end of the era of tanks, armored structures and GBAD systems. This hypothesis must be analyzed both, from the perspective of the Azerbaijanis, who chose the winning option, with allies experienced in the use of drones, and the Armenians who, apart from the fact that they failed to keep the advantages obtained in the previous conflict, suffered from the uninspired decisions of the political-military leadership. It is difficult to argue that the era of tanks is over, but it is obvious that tanks, as well as other traditional land warfare platforms, will be easy targets for unmanned aircraft systems, if there are no short-range air defense structures in their organic structure, electronic warfare systems or systems dedicated exclusively to combating UAS (Kasapoglu 2020).

Logically, any armored or GBAD system, no matter how advanced, can turn into the same piles of scrap metal that paraded in Baku's Azadliq Square[13], if there is no disciplined, trained and prepared crew or combat team. In the video images available online, it can be seen how the Armenian armored vehicles do not maneuver, but move in tight formations, as if they are on a routine movement and not a combat one, and in the situation where they are in training areas or standby does not use any form of camouflage (Bateman 2020).

The conflict needs to be studied carefully and I think it is a big mistake to approach it only through the lens of the military power of the two countries and its outcome. The trend of stagnation or even elimination of anti-aircraft artillery systems is especially visible after the end of the Cold War, and the new SHORAD/VSHORAD systems, oriented more towards threats generated by helicopters, ground attack aircraft and cruise missiles have little chance to combat small drones or swarms of drones. It is probatory that, in the recent war in Nagorno-Karabakh, "*more MANPADs were destroyed by drones than they could shoot down drone*s themselves" (Gressel 2020). This must be both thought provoking and worrying.

And yet, the specialists' opinion is that the Azerbaijani UAS operated against an opponent who was unprepared or who had not learned anything from the 1994 conflict. In the absence of a layered air defense, the existing structures were mostly arranged on fixed mountain positions, thus constituting relatively easy targets. The air defence systems at Armenia's disposal (of Soviet origin and from the early 1970s) were not developed to engage targets such as drones or swarms of drones, loitering munitions, artillery projectiles. More advanced air defense capabilities, such as the Tor-M2, were intentionally kept in reserve, and the older S-300 PS systems appeared to have played no role in the conflict (Kofman and Nersisyan 2020).

Lessons Identified:

8. Training of forces taking into account the lessons learned from previous confrontations and the permanent volatility of the operating environment;

[13] N.A: Azerbaijan celebrated its victory in Nagorno-Karabakh with a grandiose military parade in Baku's Azadliq Square. 2,783 soldiers participated in the parade, that is, the number of Azerbaijani soldiers who died in the war. What attracted attention was the display during the parade of various weapons or weapon systems, damaged or not, captured from the Armenians.

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9. The existence/presence of modern capabilities does not guarantee success, if they are not supported by training, organization, support and compatible leadership;
10. Reconsidering the importance of passive defense (early warning, dispersal, camouflage, concealment and deception, adopting a policy to control electromagnetic emissions, etc.) with a role in increasing the probability of survival.

Combating UAS may prove difficult, but not impossible. In the case of the famous TB2s, the micro munitions on board[14] have a range (stated online) of about 15 km[15], which makes them difficult for most SHORAD air defence systems to combat. At the same time, TB 2 is an example of a target for which medium-range surface-to-air missile systems have not been developed, their purpose being mainly to combat much faster aircraft or missiles.

[14] Smart Micro Munition MAM-L
[15] https://www.roketsan.com.tr/en/products/mam-l-smart-micro-munition, accessed on 15.10.2022.

Even though drones have played an important role in this conflict, their capabilities should not be exaggerated, given that they present vulnerabilities that can be exploited by a well-prepared, layered ground-based air defense. Unfortunately, however, Armenia did not have the necessary number of GBAD systems to annihilate the advantage created by the use of drones, and the Russian-supplied *Polye-21* electronic warfare systems, succeeded in disrupting the use of drones, but only for four days (Shaikh and Rumbaugh 2020). Russia, which supported Armenians during the conflict, used the *Krasukha* electronic warfare system deployed in the Armenian city of Gyumri, only in the last days of the war to interdict reconnaissance missions carried out by Azeri drones deep into Armenian territory (Gressel 2020). Electronic countermeasures or kinetic and non-kinetic systems can offer solutions for combating drones, but the big question is whether it is possible to produce them in the necessary quantities, requested by the strategic, operational and, above all, tactical level echelons.

In conclusion, the conflict demonstrated that the traditional approach to war, through the prism of the use of traditional systems, is still relevant. The traditional operations of attack and counterattack, block, delay, deny, etc. remain crucial to the achievement of the assumed objectives, while UAS or drones have now become an integral part of the planning and conduct of modern warfare.

Electronic warfare and short-range air defense systems can be the primary option to combat loitering munitions or unmanned aircraft. Between expensive interceptors, intended for typical threats to achieve strategic and operational level effects (aircraft, ballistic, cruise or hypersonic missiles), and the previously presented options, the latter are preferable and must be developed to maintain a balance between the threat generated of UAS and combating it. It is essential to understand that the projection of military power in a modern battlefield begins with the elimination of threats posed

by relatively inexpensive systems, but with a high capacity to jam or saturate the systems designed to counter them.

Nations and armies are required to modernize their air defense systems to recover the gap between the threat and its elimination, looking for methods, revitalizing systems, rethinking air defence so that combating UAS does not become much more expensive than manufacturing them. Last but not least, perhaps the most important aspect: failure to heed the lessons of this conflict may be the most painful lesson that history has to offer. Free for us, but tragic for the South Caucasus.

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