INCREASING DRONES' COMBAT EFFECTIVENESS: AN ALTERNATIVE ANALYSIS FOR INTEGRATION INTO COMPREHENSIVE MILITARY AND TECHNOLOGICAL SYSTEMS

Fatih TUNA*

ABSTRACT

While the use of armed unmanned aerial vehicles in both international military operations and internal security operations has been increasing in recent years, debates on the role of armed unmanned aerial vehicles in the international relations literature remain limited. While some experts consider armed unmanned aerial vehicle technology as a groundbreaking or game-changing development, others argue that the impact of this technological development is limited. This study presents an alternative assessment and new suggestions for increasing the effectiveness of armed unmanned aerial vehicles in conflict zones without positioning this study on any side of the ongoing debate in the literature. This study argues that armed drones should be supported by skilled military experts and modern military and electronic systems in order to make them more effective in conflicts. In order to test the accuracy of this hypothesis, this study examines Türkiye's intervention in the Libyan Civil War, Türkiye's Operation Spring Shield in Syria's Idlib province, and Türkiye's cooperation with Azerbaijan in the 44-day Patriotic War as case studies. Ultimately, the case studies uphold the hypothesis that the deployment of skilled military experts and modern military and electronic systems to support drones in combat increases their effectiveness.

Key Words: *Drone, Türkiye, Syria, Libya, Azerbaijan*

SİHA'ların Muharebe Etkinliğini Artırmak: Kapsamlı Askeri ve Teknolojik Sistemlere Entegrasyon İçin Alternatif Bir Analiz

ÖZET

Son yıllarda hem uluslararası askeri operasyonlar hem de sınır içi güvenlik operasyonlarında silahlı insansız hava aracı kullanımı giderek artarken uluslararası ilişkiler literatüründe ise silahlı insansız hava araçlarının rolüne ilişkin tartışmalar devam etmektedir. Uzmanların bir kısmı silahlı insansız hava aracı teknolojisini çığır açan veya ezber bozan bir gelişme olarak değerlendirirken, karşıt görüşlü uzmanlar tarafından ise bu teknolojik gelişmenin etkisinin sınırlı olacağı şeklinde değerlendirmeler yapılmaktadır. Bu çalışma ise literatürde devam eden bu tartışmanın içerisinde kendini herhangi bir tarafta konumlandırmadan silahlı insansız hava araçlarının çatışma sahnesinde etkililiğini artırmaya ilişkin olarak alternatif bir değerlendirme ve öneri sunmaktadır. Bu çalışma, silahlı insansız hava araçlarının çatışmalarda daha etkili kılınması için modern askeri ve elektronik savaş sistemlerinin yanı sıra becerili ve eğitimli askeri uzmanlar tarafından desteklenmesi gerektiğini savunmaktadır. Bu hipotezin doğruluğunu test edebilmek amacıyla vaka çalışması yöntemi kullanılmıştır. Türkiye'nin Libya İç Savaşı'na müdahalesi, Türkiye'nin Suriye'nin İdlib bölgesinde gerçekleştirdiği Bahar Kalkanı operasyonu ve Türkiye'nin 44 Günlük Vatan Savaşı'nda Azerbaycan'la iş birliği örnek vakalar olarak kullanılmıştır. Bahsedilen üç vakanın analizi sonucunda, çalışmanın savunduğu hipotezin geçerli olduğu sonucuna ulaşılmıştır.

Anahtar Kelimeler: *SİHA, Türkiye, Suriye, Libya, Azerbaycan*

* Res. Assist., Police Academy Institute of Security Sciences, Ankara / TÜRKİYE, fatihtuna123@gmail.com

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Introduction

Drones, which are unmanned aerial vehicles, have become a defining feature of technological developments in the defense industry in the 21st century. There are different types of drones, such as unmanned combat aerial vehicles or unmanned aerial vehicles, and these different types of models are often categorized as strategic, operational, or tactical. However, as this research intends to delve into how to increase the overall combat effectiveness of drones, such categorical differences will not be addressed in this article. To make things easier for the reader, the term "drone" will be used to represent different models of unmanned aerial vehicles that carry out different missions while in combat, such as targeted strikes, laser pointing, and surveillance. Considering the increasing number of countries that have been investing in the development or procurement of this technology, drones will continue to have an impact on the security sector in the future (Fuhrmann & Horowitz, 2017). Some even describe this development as a revolution in military affairs that will have implications for the international security structure (Heyns, 2013). Many believe that drones have significantly changed the dynamics of modern warfare because it is challenging for modern radar systems to detect them, it is easier to procure them thanks to their competitive price in comparison to other military aircraft, and they possess an effective long-range precision strike capability that minimizes costly close combat (Kreps & Zenko, 2014).

Due to concerns emanating from the proliferation of drones possessing advanced military and technological capabilities and their increasing usage in military conflicts, some scholars have called for an international accord regarding drone proliferation as drones may decide the fate of nations (Callamard & Rogers, 2020). According to Fukuyama, the inevitable spread of drone technology will erode existing power structures (2021).

The literature on drones' impact on international security has been dominated by two opposing camps claiming that either drones are a silver bullet, or they are just another type of technology developed in the security sector. Rather than taking a definitive position regarding the role of drones and their implications for international security dynamics, this alternative analysis intends to focus on how to increase the effectiveness of drones in military conflicts. By empirically evaluating three case studies in which drones have been extensively used during combat, this research suggests that drones should be incorporated into advanced military-technological systems and be supported by competent military officers in order to improve their effectiveness on the battlefield.

1. Literature Review

Looking at the existing literature regarding the role of drones in military confrontations, there are two opposing camps on the role of drones in combat.

According to Stulberg, drones will reshape the warfare and military technology of the 21st century (Stulberg, 2007). Singer notes that the rising role of drones will become a turning point in military combat (Singer, 2009). Rogers compares the drone revolution with the gunpowder revolution (Rogers, 2020). Furthermore, it is argued that the international competition for drone technology will reconstruct the dynamics of armed confrontations (Boyle, 2015). Because of their advanced technology and size, drones can evade radar and defense systems (Mayer, 2015). Thanks to their competitive price, drones can be more easily procured and employed during armed conflicts (Hayward, 2013). Additionally, states prefer to use drones rather than deploying boots on the ground and risking the lives of soldiers (Fuhrmann et al., 2016).

Some other pundits take the drone revolution argument with a grain of salt. It is argued that drones may not drastically reshape the dynamics on the ground or dramatically change the

balance of power as powerful and technologically advanced countries have already largely employed drones in their militaries for different purposes (Joshi & Stein, 2013). Militaries could also use other technological platforms or aircrafts other than drones to reach their goals (Colon et al., 2015). Those who question drones' uniqueness state that drones are vulnerable to radar and air defense systems due to their technological limitations and low speeds (Davis, et al., 2014). Thereby, these scholars contend that the impact of drone technology in military conflict is limited.

The existing literature also covers the vulnerabilities of drones as well as their importance for international security. Currently, drones fly markedly slower than warplanes, making them easy targets for adversaries' faster combat aircrafts as well as well-developed air defense systems (Majumdar, 2013). Additionally, the communications system of drones that enables connection between the remote controller and the vehicle could be hacked (Sternstein, 2015). By launching a cyber-attack and cutting the communication between a drone and its operation station, an enemy could easily eliminate drones in combat. Moreover, even though drones could serve as significant force multipliers against targets in the field, they have highly limited defensive capabilities to protect themselves from enemy aircraft as well as air defense systems (Aviation Week Network, 2014). One could claim that the majority of the tasks carried out by drones can also be carried out by other military-technological systems such as war planes, helicopters, and other relevant aircrafts, considering that they also have the capability to carry more sizeable cargo (Davenport, 2015). Additionally, drone operators work more than ten hours per day, and their yearly flight hours are around five times longer than other aircraft pilots. This situation puts extreme pressure on drone operators, making them vulnerable to stress-related psychological disorders. As a result, it has been reported that there is a high level of attrition among personnel who have been working as drone operators (McGarry, 2015).

Despite these setbacks, it is a mistake to simply dismiss drones as just another technological military system. One of the most outstanding benefits of using drones is that drones have operators who control them without risking their own lives. A state can target its adversaries by employing combat drones without risking its own soldiers. The reduction of the mortality rate in conflicts thanks to drones also makes them attractive and preferable for decision-makers to appease their populations. Rather than deploying boots on the ground and risking the lives of their sons and daughters, employing drones to target enemies is popular among democratic societies. For example, since 2011, more than 60 percent of the U.S. public has supported using drones in its military missions (Horowitz, 2016). Apart from minimizing the fatality rate, the chance of losing drones against targets that do not possess sophisticated air defense systems is low. While other military aircrafts can fly faster than drones and may carry more cargo, it should be pointed out that albeit slower, drones can fly far longer hours over potential targets during military operations while loaded with bombs (Kreps, 2013). Flying over potential targets for much longer than other military aircraft makes it easier to effectively detect targets without making mistakes. Additionally, missiles that have been launched from drones during an operation can be redirected until they reach their target, enabling drone operators to pinpoint their strike without harming civilians (Lewis, 2013). The element of deniability is also another advantage of using drones in combat. States can use drones to eliminate their targets while at the same time denying that they were behind the operation thanks to drones leaving limited tracks in comparison to other military aircraft or ground forces employed to carry out tactical and strategic operations.

Considering that drones have several distinct advantages for parties employing them in combat, it would be unjust to dismiss them as another military technology. However, it is also

equally important to note that drones also have some apparent deficiencies that must be perfected in the next generation of technological developments in that area.

2. Puzzle

According to existing literature, scholars, journalists, and experts who are exploring the field of drone technology are generally divided into two opposing sides: those who claim that drones have revolutionized the dynamics of warfare and those who question drones' impact as a game-changing technology. However, there is no need to take part in either one of these camps regarding the impact of drones on military conflicts. Both of these understandings have significant deficiencies as outlined in the literature review above. Hence, this research intends to find common ground between the competing camps in the existing literature by offering an alternative analysis to increasing drones' combat effectiveness by integrating them into comprehensive military and technological systems. By presenting an alternative analysis and making suggestions to boost their combat effectiveness, this study aims to surmount the polarized perceptions regarding drones in the existing literature and contribute to the international security literature.

3. Research Design

The main objective of this research is to develop an alternative analysis to strengthen drones' effectiveness in armed conflict based on recommendations gleaned from empirical observations. This study positions itself outside the competing arguments in the literature on drones' role in military technology, which is separated between those that portray drones as a revolutionary power and those that dismiss this development as just another technological platform used in military conflicts. This analysis supports neither of these understandings and promotes an alternative account regarding how to improve drones' role in armed combat as a determinant force multiplier.

The central argument defended in this research is that drones alone cannot change the balance of power in the battlefield. Therefore, to make drones more effective on the battlefield, they have to be supported by modern electronic warfare systems and competent military officers.

It is important to underscore that no military force, weaponry, or technological capability, including drones, alone can guarantee triumph on the battleground. All factors at a state's disposal should be integrated with other forces, arms, and electronic systems. It must also be remembered that enemies and adversaries are also constantly developing countermeasures for each weapon, electronic system, and combat capabilities that have been used during conflicts. Indeed, this has been the case in the military operations covered in this study: for example, Türkiye's signal warfare systems detected and located the Libyan National Army's (LNA) radar systems during the LNA's offensive against the internationally recognized Government of National Accord (GNA) in Libya. In response, the LNA shut off its own radar and activated optical sensors in order to protect itself from being targeted by Turkish electronic systems. Though this tactical move helped the LNA target some Turkish-made drones, it did not change the overall strategic battlefield dynamics (Pack & Pusztai, 2020). Similarly, during Türkiye's operation against regime forces in Syria's Idlib province, Turkish electronic signal systems—namely ASELSAN-made KORAL electronic warfare systems—hacked the regime soldiers' cell phones, blinded Russian-made electronic systems by sending false signals, and located the positions of regime forces. Additionally, TB2 Bayraktar and TUSAŞ-made Anka drones heavily targeted regime soldiers' geolocations. However, in response, Syrian regime soldiers stopped using cell phones during operations and changed their communication style to produce fewer electronic signals, and it became harder to detect their whereabouts (Urcosta,

2020). Likewise, in the 44-day Patriotic War, Armenian forces replaced their Soviet-era air defense systems with more effective Russian-made electronic warfare and air defense systems against Azerbaijan during the later phases of the war (Shaikh & Rumbaugh, 2020).

TB2 Bayraktar drones use lightweight smart micro munition (MAM), which was developed and produced by Turkish Roketsan company. MAM has a diameter of 160 mm. Its length is one meter, and its weight is 22 kg. The range of MAM is around 15 kilometers, and it has laser guidance, enabling its operator to direct the smart munition even after its launch. It can successfully target and eliminate battle tanks, armored vehicles, and military personnel. MAM has thermobaric and armor piercing warheads that cause blast fragmentation thanks to its high explosive design. MAM has impact and proximity fuse types (Roketsan, n.d.). BOZOK is another smart ammunition that has been used by Anka as well as Bayraktar drones. It was developed by TUBITAK's Defense Industries Research and Development Institute (SAGE). It has a diameter of 120 mm. Its length is 1.2 meters, and its weight is 16 kg. BOZOK has 15 kilometers of extended range, and it has laser guidance (Militarynyi, 2022). It can hit targets of opportunity and planned targets, and it has anti-personnel operation capabilities. BOZOK has precision guidance and effective warheads; it is a new-generation armed drone munition (TUBİTAK SAGE, n.d.). KORAL is a mobile radar electronic warfare system that has been developed and produced by Türkiye's ASELSAN company. KORAL has a modular system design and highly sensitive multi-receiver architecture. It has a wide frequency and spatial coverage to intercept enemy signals. It can automatically identify threats by using its threat library. It can operate with high pulse repetition frequency and in a continuous wave environment. Its antenna has high precision direction-finding capabilities. KORAL can handle both traditional and emerging threat signals by automatically jamming threat signals. It can simultaneously apply multiple jamming and deception techniques against its targets (ASELSAN, n.d.). HISAR air defense and missile launching system is another military technological platform that has been developed and produced by Türkiye's ASELSAN company and was successfully deployed to defend the GNA in Libya. It is a critical platform to ensure air defense against enemy aircrafts, helicopters, drones, and missiles. It has a multipurpose missile launcher unit that uses short- and medium-range air defense missiles that have been produced domestically. While HISAR is a state-of-the-art technology, it is open to upgrades, and it can be upgraded with future technologies to further its technical abilities. It has multi-purpose missile launchers and midcourse guidance capabilities. It can operate in day and night as well as in adverse weather conditions. It can be remotely guided, and since it is a mobile system, it can be repositioned in tactical areas. It has fast deployment capabilities and short start-up. Its interception rage is between 15 to 25 kilometers. It has a max road speed of 65 km per hour (ASELSAN, n.d.).

In 2019, more than 1,000 drone strikes were reported in the Libyan civil war between the GNA and the LNA. Around 850 of these strikes were carried out by the LNA, while the remaining 250 strikes were conducted by the GNA (United Nations Security Council, 2020). Before Türkiye's intervention to support the internationally recognized GNA in Libya, the GNA almost lost the entirety of their 24-drone fleet during the conflict (Cole & Cole, 2020). The LNA primarily used Russian Pantsir S-1 air defense systems provided by the UAE to down the GNA's drone fleet. Pantsir S-1 is a short-range surface-to-air defense system that has a 20-kilometer range. Its warhead is 20 kilograms, and it has a high explosive fragmentation feature (Missile Threat, 2021). The LNA's deployment of its Russian-made Pantsir S-1 air defense systems pressured the GNA to end its drone strike operations. However, Türkiye's deployment of air defense and electronic warfare systems such as HAWK, which were replaced later on by HISAR, and KORAL to the Libyan theater changed the balance of power. The superiority of

Turkish-made electronic warfare systems allowed the GNA to shoot down the LNA's drones and incapacitate their radar systems. This development shows the technological superiority of Turkish-made electronic warfare platforms, which allowed the GNA to commence its drone campaign and gain momentum on the ground.

Before its more comprehensive military involvement, Türkiye had already provided some drones to the GNA; however, the GNA could not utilize them properly to carry out successful drone operations against the LNA during the early phases of the war. After Türkiye deployed its domestically produced air defense and electronic warfare systems as well as competent military officers to Libya, the balance of power on the ground was shifted in favor of the GNA (Bakir, 2021). As Türkiye's comprehensive military intervention has drastically changed the balance of power in Libya, it can be argued that Türkiye's electronic warfare and air defense systems are technologically superior. Additionally, as the GNA's military forces already possessed some Turkish-made drones before Türkiye's deployment of additional forces to prop up the GNA but failed to use them properly to achieve superiority during combat, it can be inferred that Türkiye's military personnel are more experienced, well-trained, and have more high-level competencies in terms of utilizing technologically sophisticated military-technological platforms against adversaries.

During Türkiye's Operation Spring Shield in Syria's Idlib province in 2020, the Syrian regime used the aforementioned Russian-made Pantsir S-1 air defense systems as well as the BUK-M2 medium-range air defense missile systems, which have up to a 20-kilometer range and can simultaneously track 24 targets and engage with four of them at once (Military Today, n.d.). Despite the fact that Syrian regime forces used Russian-made short- and medium-range air defense systems, Turkish forces successfully geolocated and blinded enemy military-technology systems as well as armored forces (Hız, 2020). This accomplishment was due to the technological superiority of Turkish electronic warfare systems and the competent military personnel who have been utilizing them. Apart from this, it should also be mentioned that Turkish drone operators successfully carried out extensive drone squadron attacks to target regime elements in Idlib (Nicholson, 2020). According to data publicized by the Turkish National Defense Ministry, 3,473 regime forces, 93 tanks, 36 armored vehicles, ten air defense systems, three aircrafts, and eight helicopters belonging to the Syrian regime were eliminated (Turkish National Defense Ministry, n.d.). As a result, Türkiye's overall military dominance can be attributed to the superiority of the Turkish-made electronic warfare systems, drones, and other relevant military platforms as well as the competent Turkish military officers who have successfully and effectively utilized them to ensure Türkiye's victory in combat.

In its 44-day Patriotic War against Armenia, Azerbaijani drones armed with MAM and produced by Türkiye's Roketsan company heavily targeted Armenian air defense systems. Those air defense systems were mainly Russian-made short-range 9K33 OSA missile systems with an improved range of 12 kilometers (Army Technology, 2022). The Armenian side also used Strela-10 short-range air defense missile systems that have a 5-kilometer range (Military Today, n.d.). These Armenian platforms, mainly produced in the Soviet Union, were mostly neutralized with drones used by the Azerbaijani side during the war (Oryx, 2020). Armenia did not have fully integrated air defense systems, which made its military forces more vulnerable to Azerbaijani drones during the conflict (Kofman & Nersisyan, 2020). The military-technological superiority of Turkish-made technological platforms and smart ammunitions, as well as the tactics developed by the Azerbaijani side with the help of Türkiye, ensured Armenia's defeat in this war. The success of this military operation, which will be elaborated in detail in the case study section of this analysis, further underscores the importance of military

officers' competency and the superiority of Turkish platforms as having a determinant role in combat.

In all three combat operations, Turkish-made drones and smart ammunitions enabling precision targeting of enemy units were heavily utilized. However, for national security reasons, it is currently almost impossible to find publicly available information related to the exact number of Turkish drones participating in these combat missions, their overall flight durations during operations, and the exact number of drone strikes carried out by these drones. According to Baykar's official website, the Bayraktar TB2 drone has successfully completed 600,000 flight hours (Baykartech.com, n.d.). According to the Turkish state-run news agency, Bayraktar TB2 drones' total flight duration during Türkiye's Operation Spring Shield was more than 2,000 hours (Yanık, 2022). According to Witt, Bayraktar TB2 drones conducted more than 800 strikes in these combat missions as of May 2022 (Witt, 2022).

Due to the successful operations carried out by the Turkish military officers who operate drones from their operation center, it is safe to assume that these officers have been receiving sufficient training. Again, we cannot access the entirety of the training program for national security reasons. According to publicly available sources, it is believed that the training of combat drone pilots lasts around six months (Erdem, 2022). We also know from open sources that Bayraktar TB2 drones' production company, Baykar, provides additional training to Turkish military officers who will become drone operators after they successfully complete their training. This was announced via the social media account of the chief engineer behind the Turkish drone revolution, Selçuk Bayraktar (Yeni Şafak, 2017). Bayraktar graduated from Istanbul Technical University, received a scholarship to resume his graduate studies at the University of Pennsylvania, and then at MIT (Pitel & Jalabi, 2022). We can assume from Bayraktar's strong educational background that the officers receiving training at his company are receiving a similarly strong educational background regarding drones, and this situation positively affects the outcomes of the military operations in which drones have been extensively used.

One can claim that Turkish drones are regarded as superior to many of their competitors. This superiority has been openly articulated by the President of Türkiye, Recep Tayyip Erdoğan. According to Erdoğan, "Türkiye has become one of the 3 most advanced countries in combat drone technology" (Bayar, 2021). Indeed, Türkiye is regarded as one of the strongest drone superpowers, together with the United States, China, Israel, and Iran. Türkiye's position as a drone superpower is not only rhetorical but also a reality. It exports its drones to a variety of countries including NATO member Poland (Pitel & Jalabi, 2022). Another NATO member, Romania, also signed an agreement with Turkey's Baykar company in April 2023 to procure 18 TB2 drones worth USD 321 million (Al-Monitor, 2023). This situation clearly emphasizes the fact that Türkiye's unmanned military platforms have technological superiority over its competitors. The superiority of Türkiye's armed drones and electronic warfare systems also have been praised by former British Defense Secretary Ben Wallace. Türkiye's skillful use of electronic warfare systems, armed drones, and smart munitions has been described by Secretary Wallace as "game changing" (Wallace, 2020).

Conceivably, Turkish military officers are well-trained, and they have sufficient combat experience due to ongoing regional instability and insecurity. They are more competent than others in terms of productively utilizing Turkish-made electronic warfare and air defense systems as well as domestically produced armed drones and smart munitions. Turkish technological platforms are also technologically superior to their competitors. Türkiye's elevated status as a drone superpower, its export of military-technological platforms to many

different countries including NATO members, and its successful utilization of these platforms thanks to its competent drone pilots who are able to reach combat objectives during operations clearly indicates Türkiye's superiority in this new field of modern warfare.

Even if adversaries develop the capabilities to readapt their military infrastructure to encounter this relatively new military technology, the force multiplier effect of drone systems during conflicts should be stressed. Force multipliers are assets that outstandingly improve combat potential and thereby enhance the likelihood of the force that employs that particular asset during conflict will accomplish its mission. Time and time again, Turkish-made drones have proved to be the true force multipliers in combat by inflicting heavy casualties on enemy forces in Libya, Syria, and Azerbaijan (Kasapoğlu, 2022).

In one sense, this study's objective is to analyze the relations between certain phenomena. In this regard, the independent variable in this study is additional support for drones, namely complementary military and technological systems and competent military officers who can use these systems effectively in combat. The dependent variable is the combat effectiveness of drones.

The main hypothesis that is tested in this research is that additional support coming from military and technological systems as well as competent military officers have a positive impact on increasing the combat effectiveness of drones. To verify this hypothesis, three military conflicts in which drones are used in combat will be analyzed as case studies. Türkiye's military intervention in the Libyan Civil War, Türkiye's Operation Spring Shield in the Northwestern Syrian province of Idlib, and Türkiye's material and practical support to Azerbaijan during the 44-day Patriotic War will be analyzed as case studies as all three conflicts saw the extensive use of drones together with other complementary military elements. The selection of these cases will provide an opportunity to test the hypothesis of this research.

The empirical evidence to analyze these cases was collected from primary sources, including from statements and official documents issued by government figures and institutions, and secondary sources from the literature prepared by academics and experts in the field. Other open-source data as well as public information from reliable media outlets will also be employed to support this analysis. It must also be noted that most of the available resources are mainly produced either by state or international organizations that have certain agendas. This is a significant limitation of this research. Thus, documents produced by these parties can be biased or partial. To overcome this reliability and objectivity problem, a comparative analysis of conflicting resources will be conducted.

It must also be mentioned that there is an additional limitation in this research in terms of increasing the effectiveness of drones in combat. Integration with other related battlefield function areas, including but not limited to fire support, maneuver, command-control information systems, and combat service support, could also increase the effectiveness of drones during combat. However, this research only examines air defense systems, electronic warfare systems, and the use of special forces in the three specified missions. Thereby, this could be considered as another limitation of this research article. Further research covering the aforementioned battlefield functions and their implications on the effectiveness of drones would be an essential contribution to the international security literature in future.

4. Case 1: Türkiye's Military Intervention in the Libyan Civil War

After NATO's 2011 military operation in Libya, the country's strongman, Muammar Qaddafi, was eliminated, and a civil war ensued. There are two main parties in the civil war, effectively separating Libya into two parts. On the one side, the Tripoli-based Government of National Accord (GNA), which is officially recognized by the United Nations (UN), is actively

controlling the western part of Libya. On the other side, the Tobruk-based Libyan National Army (LNA), supported by Egypt, Russia, and the United Arab Emirates (UAE), is controlling the eastern part of the country (Lacher, 2020). At the time Türkiye intervened in the Libyan civil war as a balancer to support the GNA, the GNA was led by Fayez al-Sarraj. Currently, the GNA leader is Abdul Hamid Dbeibeh. The leader of the LNA is Khalifa Haftar.

Türkiye's intervention came during the LNA's Tripoli offensive, during which Haftar's forces came very close to controlling the GNA's capital. In a sense, Türkiye played a balancing role against the LNA's offensive targeting the GNA. According to the UN Secretary-General's special representative to Libya, by November 2019, the LNA had carried out more than 800 drone strikes, whereas the GNA had only carried out 240 drone strikes (United Nations, 2019). Hereby, this case seems to be suitable for testing this study's hypothesis on the ability of drones to increase effectiveness in combat.

Both the GNA and the LNA targeted and downed each other's drones thanks to their air radars and defense systems, which both included surface-to-air missile capabilities, during the LNA's offensive on Tripoli (Gady, 2019). This reality verifies at least the first part of the hypothesis of this research, which is that drones alone cannot change the balance of power in the battlefield. Until Türkiye's direct involvement in the civil war, the GNA almost lost the entirety of its 24-drone fleet (Pack & Pusztai, 2020). Reportedly, the LNA's drones were also heavily targeted as around half of its drone inventory was lost in the offensive (Drone Wars, n.d.). The UAE supplied Russian-made Pantsir S-1 air defense systems to the LNA, which were able to neutralize the GNA's drones (Pack & Pusztai, 2020). Likewise, the GNA also downed a considerable number of the LNA's drones, albeit it had relatively underdeveloped air defense capabilities in its military arsenal (Pack & Pusztai, 2020).

While developments in the field indicated that the LNA was about to defeat GNA forces, Türkiye's military intervention in the Libyan civil war dramatically changed the balance in this theater. In late 2019, Türkiye started to deploy its military officers, military advisors, and electronic warfare systems to locations that are strategically significant for the GNA's defense (Wintour, 2020). In addition to Bayraktar TB2 and TUSAS-made Anka drones, Türkiye also deployed HAWK air defense system and ASELSAN-made KORAL mobile electronic warfare systems to Libya (Pack & Pusztai, 2020). Later on, it has been reported that Turkey has replaced HAWK systems with its domestically produced ASELSAN-made HISAR air defense and missile systems (TRHABER, 2023). With the swift operationalization of Türkiye's modern air defense systems, the LNA began to lose its air superiority in the Libyan Civil War (Pack & Pusztai, 2020). Turkish air defense and missile systems shot down many LNA aircraft, including drones.

Turkish KORAL systems played a determinant role during combat by geolocating and blinding the LNA's drones, air defenses, and radar systems. KORAL systems first detected the signals generated by the LNA's electronic warfare capabilities. This electronic signal detection process enabled KORAL systems to geolocate the positions of the LNA's electronic warfare tools. After their geolocation, KORAL systems started to send artificial signals to the enemy's air defense and other relevant electronic warfare systems. By bombarding the LNA's radars and other electronic warfare systems with its signal technology, KORAL blinded them, making them effectively useless during combat. By detecting and blinding the LNA's air defenses and drones thanks to KORAL systems, the GNA started to gain air superiority (Pack & Pusztai, 2020).

Signals generated by KORAL systems also distorted Wing Loong drones, which were produced by China and supplied to the LNA by the UAE. KORAL systems also blinded

Russian-made air defense systems at the disposal of the LNA, such as Pantsirs, SA-6s, and S-125s. KORALs suppressed most of the Russian-made LNA air defense systems to the level that Turkish Bayraktar TB2 drones were able to obliterate more than 15 Russian Pantsirs even though their radars were active in the Libya theater (Bakir, 2021).

These Turkish Bayraktar and Anka drones, as well as ASELSAN-KORAL systems, were operated by competent Turkish military advisors deployed in the field (Pack & Pusztai, 2020). After heavily crushing the LNA's air superiority by annihilating most of its drones and air defense systems, the LNA was forced to end its failed siege of Tripoli. After the LNA's defeat and withdrawal, the GNA recaptured many strategic locations. In brief, a balance was re-established on the ground thanks to heavy Turkish support, including drones, electronic warfare systems, and military advisors.

The success of Turkish military officers in the field supports the second part of the hypothesis. Indeed, modern electronic warfare systems' and competent military officers' support made the GNA's drone warfare more effective on the battlefield. Before Turkish intervention the GNA was already operating drones, but it was sustaining heavy loses. The failure of the GNA's drone campaign before Turkish intervention can be attributed to the shortcomings of the GNA military officers who were operating the drones in the battlefield and their inability to challenge the LNA's air defense and radar systems. After Turkish involvement, Turkish military advisors presumably began operating the drones, as well as KORAL systems, that incapacitated the LNA's air defenses. Under these new circumstances on the ground, the GNA's drones heavily targeted the LNA's positions without any significant challenge. By integrating competent Turkish military officers who operated these comprehensive electronic warfare systems in combat, the drones' effectiveness was substantially maximized.

5. Case 2: Türkiye's Operation Spring Shield

Since the beginning of the civil war in 2011, different military actors have been using different types of drones in Syria. Many of these drones have been continuously shot down by different air defense systems during the war. For instance, Turkish air defenses managed to down Russian-made Orlan-10 drones (Reuters, 2015). Likewise, when Syrian opposition forces targeted the Russian Khmeimim air base with a swarm attack using scores of drones, Russian air defenses managed to fend off this drone attack (Urcosta, 2020).

Although many parties involved in this conflict have used drones at different stages of the civil war, drone warfare in the conflict reached an unprecedented level in 2020. Türkiye massively utilized drones during its Operation Spring Shield in the Northwestern Syrian province of Idlib, which began as a counter-offensive after the Russian or Syrian regime killed 34 Turkish soldiers around the village of Balyun in Idlib province (Kemal, 2021).

The extensive use of drones during Operation Spring Shield provides another opportunity to test the hypothesis regarding drones' effectiveness. While focusing on the details of this operation, one can easily observe that Türkiye's tactical victory came not only from drones but also from the deployment of competent military officers and additional military-technological systems. During the Turkish counter-offensive, in which domestically produced drones were heavily used, Syrian regime forces possessed Russian-made Pantsir and Buk surface-to-air missile systems. It would be incorrect to state that Russian air defense systems were overwhelmed simply because of their technological inferiority. Rather, the Syrian regime military officers who were operating these platforms were not properly trained and therefore did not know how to effectively operate such systems (Parachini & Wilson, 2020). Because of their deficiency in training, regime forces revealed their locations to Turkish forces. The

incompetency of Syrian regime troops increased their vulnerability and made them easy targets for Turkish drone campaigns in Idlib province.

Contrary to the situation of the Syrian regime, Türkiye managed to deploy recently developed and technologically advanced defense systems and competent military experts who could actively and productively use these newly produced military platforms during Operation Spring Shield.

During its Idlib counter-offensive, Türkiye geolocated Syrian regime elements by hacking their communication systems through skillfully using ASELSAN-KORAL electronic warfare systems. Signals generated by Syrian regime soldiers during their unit-to-unit communications were intercepted by Turkish-made KORAL electronic systems. By tracking these signals, competent Turkish military officers not only found regime soldiers but also radars, air defense systems, and other military targets including armored vehicles. After geolocating the enemy's electronic air defense capabilities, Turkish forces started to send artificial signals by utilizing KORAL and blinded Syrian air defenses. After blinding the Syrian Regime's Russian-made air defense systems, Turkish drones dominated Idlib province's airspace and obliterated the enemy targets found through geolocation (Bakeer, 2020).

Turkish drones destroyed more than 150 tanks, many aircraft, including, drones, helicopters, and Russian Su-24 aircraft, and as many as 100 armored vehicles (Bakir, 2021). Most importantly, Turkish drones purportedly crushed at least eight Russian Pantsir air defense systems while their radar was active (UAWIRE, 2020). According to video footage made public by the Turkish Ministry of National Defense, a USD 14 million Russian Panstir air defense system was destroyed by firing a single shot from the newly developed smart micro-munitions developed by Turkish Roketsan company, which was fired from a Turkish drone operated by Turkish military officers and supported by the KORAL electronic signal warfare system (Hız, 2020). The destruction of eight Russian Pantsir systems was a significant development in the conflict, because not only are each of these systems valued at around USD 14 million, but they were also essentially designed to prevent threats originating from aircraft, including drones.

The Turkish military's effective geolocating and blinding of the Syrian regime's air defenses using KORAL electronic systems, relaying the targets' locations to drone operators, and successful obliteration of enemy positions and capabilities clearly demonstrate the Turkish military's effective use of modern military systems. The case of the Syrian Civil War also shows that successful operations are not made by simply using drones but rather by integrating them into a wider network of military-technological systems and deploying skilled military officers to operate them.

6. Case 3: Türkiye's Support to Azerbaijan during the 44-Day Patriotic War

Türkiye's material and practical support to Azerbaijan during the 44-day Patriotic War against Armenia in September 2020 is the third and last case that will be analyzed to test the hypothesis. So far, the previous cases of Türkiye's intervention in the Libyan Civil War to support the GNA and Türkiye's Operation Spring Shield have verified the hypothesis. In both cases drones' effectiveness during combat was significantly increased through the expertise of competent military officers and additional electronic warfare systems, most notably the ASELSAN-made KORAL electronic signal warfare system.

Many pundits claim that Azerbaijan heavily relied on drones during its 44-day war against Armenia and that drones played a decisive role during the conflict (Suciu, 2020). Since the early days of the Patriotic War, the role of additional technological capabilities and competent military officers helped to improve the combat capabilities of drones used by

Azerbaijani forces over Armenian targets. Turkish Bayraktar and Israeli Harop and Harpy drones equipped with smart munitions produced by Turkish domestic military industries inflicted heavy casualties and destroyed dozens of short- and medium-range Russian-made air defense systems, such as OSA and Strela, as well as large-scale S-300 systems used by the Armenian side (Kasapoğlu, 2020).

Most of the Armenian air defense systems were at least half a century old, Soviet-made, medium-range platforms that could neither match Turkish and Israeli technology supplied to Azerbaijan nor effectively detect the location of drones because of their inferior signal systems (Kofman & Nersisyan, 2020). While Armenia lacked advanced and integrated radar and air defense systems as well as properly trained military officers operating them, Azerbaijani forces enjoyed their advanced military technological edge and shrewdly used state-of-the-art military tactics during the war (Kasapoğlu, 2020). It has been speculated that Turkish military general Bahtiyar Ersay directed Azerbaijani military operations against Armenia on the field as after the war Turkish General Ersay became an advisor to the Azerbaijani Minister of National Defense (SDE, 2022). Under the alleged command of General Ersay, Azerbaijani forces used old Russian agricultural planes as decoys to geolocate the positions of Armenian radar and air defenses (Fogel & Mathewson, 2021). After retrieving their location, Turkish KORAL systems sent intense signals to Russian-made Armenian air defenses and blinded them, as was the case in Libya and Syria. After KORAL located these targets, Turkish and Israeli drones used by Azerbaijani forces wiped out Armenian radar and air defense systems (Bakir, 2021).

Military operations on the ground also increased the effectiveness of Azerbaijan's drones. Turkish military generals allegedly directed the day-to-day military operations and drone warfare against Armenia during the 44-day Patriotic War (Hayrapetyan, 2021). In addition to its strategic military technology infrastructure, Türkiye also deployed its military advisors and specialists to Azerbaijan (Miron & Thornton, 2020).

Azerbaijani Special Forces, who were trained and supported by Turkish military advisors, infiltrated areas controlled by Armenia and marked the locations of strategic Armenian military positions with lasers, which enabled Turkish drones to easily target them (Miron & Thornton, 2020). When there was fog during some periods of the 44-day Patriotic War, drones became effectively useless. To fill that gap, competent Azerbaijani Special Forces were deployed to critical locations to compensate for the drones that were unable to operate in poor weather conditions (Spencer & Ghoorhoo, 2021). Utilizing capable servicemen in support of drones not only became a contributing factor to increasing their efficacy but also changed the balance of power during critical phases of the conflict.

The almost unchallenged domination of Armenian airspace by Turkish and Israeli drones at the disposal of Azerbaijani forces was reinforced by not only the drones themselves but also a number of additional factors. The Armenian military was using inferior air defense technology, and furthermore, its troops were not able to effectively operate these systems. In contrast, Azerbaijan was supplied with advanced technological capabilities by its regional allies, such as Türkiye and Israel, and was provided practical support on the battlefield from Türkiye. These significant factors enabled Azerbaijan to operate drones more effectively during the 44-day Patriotic War.

Developments during Azerbaijan's 44-day Patriotic War against Armenia also confirm the hypothesis put forth in this research study. In this war, just like in the conflicts in Libya and Syria, drones alone did not bring victory for the party that extensively used them. Drones are vulnerable to air defense systems employed by enemy forces, and therefore, these air defenses have to be overcome. To realize this objective, electronic warfare systems, such as renowned KORAL systems, and capable military forces had to be employed. To put it simply, these drones

had to be further integrated into comprehensive military and technological systems to increase their effectiveness during combat.

Conclusion

While most of the existing body of literature regarding drones and drone technology is polarized on whether drones are revolutionary or just another technological development, it often neglects debates about how to improve the effectiveness of drones in conflicts. One of the objectives of this analysis was to fill this gap in the existing international security literature on drones. By not placing itself in either of these polarized camps, this article offers an alternative analysis of how to increase drones' combat effectiveness by calling for further integration of drones into comprehensive military and technological systems. To test this hypothesis, three cases have been empirically analyzed. Because of the large-scale deployment of drones in each of the conflicts, Türkiye's military intervention in the Libyan Civil War, Türkiye's Operation Spring Shield in the Northwestern Syrian province of Idlib, and Türkiye's material and practical support to Azerbaijan during the 44-day Patriotic War were selected as case studies in this investigation.

The empirical analysis of these case studies has demonstrated that drones dominated the theater of war only after the enemy's air defense capabilities were made obsolete thanks to electronic warfare systems. KORAL electronic warfare systems, developed by the Turkish ASELSAN company, played a particularly outstanding role in terms of rendering the enemy's air defenses useless by geolocating and blinding enemy drones through its signal technology. In addition, competent military officers played a key role as they skillfully used these KORAL systems to locate and blind the enemy's air defenses and obliterate them by launching smart military munitions as drone operators. All in all, analyzing these three cases substantiates the hypothesis put forward in this research study, which claims that drones alone cannot change the balance of power on the battlefield. Therefore, to make drones more effective on the battlefield, they must be supported by modern electronic warfare systems and competent military officers.

This alternative analysis contributes to the literature on international security from a critical perspective. The analysis developed in this research could also influence national security policies and state strategies by taking this critical view into account. As the use of drones in conflict, whether by states or non-state actors, has exponentially increased, relevant parties working in the security sector could benefit from this analysis.

The critical analysis propounded in this research could also be used in developing strategies for the technological development of states' security sectors and procurement policies. As drones are a popular topic in the international media, press coverage of drones as well as open-source technical and academic reports should also highlight drones' integration within additional electronic warfare systems. This article also concludes that states should follow a more balanced approach in terms of acquiring drone technology. Considering the fact that drones are not silver bullets and they can also be exposed to the enemy's defense capabilities, additional systems should be supplied to support them. A more balanced and diversified approach should be implemented by also investing in electronic signal systems and training military personnel who would use them during operations.

It is almost impossible to cover all aspects concerning drone technology and its impact on international security in one research study. There are many different subjects about drones' role in combat and their implications for international security dynamics that should be covered in detail in further studies. This research primarily focused on the role of the drones developed and operated by Türkiye. It must also be noted that global powers such as the United States and

China have their own advanced drone programs with technologically superior capabilities. Perhaps this dimension should also be analyzed in future studies. Given the rapid technological advances in drone technology and their increasing usage in international security operations, our theoretical and critical understanding of this technology could dramatically change in the future. Further academic inquiries should be carried out to monitor the developments in this field and its implications for international security.

Information Note

The article has been prepared in accordance with research and publication ethics. This study does not require ethics committee approval.

References

Al-Monitor (2023, April 26). Turkey inks $321 million deal with Romania for Bayraktar military drones. https://www.al-monitor.com/originals/2023/04/turkey-inks-321-million-deal-romania-bayraktar-military-drones

Army Technology (2022, August 25). 9K33 Osa Air Defence Missile System, Russia. https://www.army-technology.com/projects/9k33-osa-air-defence-missile-system-russia/

ASELSAN (n.d.) KORAL II Mobile Radar Electronic Warfare System. https://wwwcdn.aselsan.com/api/file/KORAL-II_ENG.pdf

ASELSAN (n.d.). HISAR Missile Launching System. https://wwwcdn.aselsan.com/api/file/HISAR_eng.pdf

Aviation Week Network (2014, March 10). U-2 has the edge over Global Hawk. http://aviationweek.com/awin/u-2-has-edge-over-global-hawk

Bakeer, A. (2020, March 26). The fight for Syria's skies: Turkey challenges Russia with new drone doctrine. https://www.mei.edu/publications/fight-syrias-skies-turkey-challenges-russia-new-drone-doctrine

Bakir, A. (2021, September 27). Turkey's electronic warfare capabilities: The invisible power behind Its UACVs. https://rusi.org/explore-our-research/publications/commentary/turkeys-electronic-warfare-capabilities-invisible-power-behind-its-uacvs

Bayar, G. (2021, August 29). Turkey among top 3 countries in world in combat drone technology. https://www.aa.com.tr/en/science-technology/turkey-among-top-3-countries-in-world-in-combat-drone-technology/2349922#

Baykartech.com (n.d.). Bayraktar TB2. https://baykartech.com/tr/uav/bayraktar-tb2/

Boyle, M. J. (2015). The race for Drones. *Orbis, 59*(1), 76-94.

Callamard, A. & Rogers, J. (2020, December 1). We need a new ınternational accord to control drone proliferation. *Bulletin of Atomic Scientists*.

Cole, C. & Cole, J. (2020, July 1). Libyan war sees record number of drones brought down to earth. https://dronewars.net/2020/07/01/libyan-war-sees-record-number-of-drones-brought-down-to-earth/

Colon, C. R., Fricker, M. S., Plaw, A. (2015). *The drone debate: A primer on the U.S. use of unmanned aircraft.* Rowman and Littlefield.

Davenport, C. (2015, August 27). The F-35 vs. the A-10 Warthog, Head-to-Head in Close-Air Support. https://www.washingtonpost.com/news/checkpoint/wp/2015/08/27/as-it-fights-for-its-life-the-a-10-will-face-off-against-the-f-35-in-close-air-supporttest/

Davis, L. E., McNerney, M. J., Chow, J. S., Hamilton, T., Harting, S., Byman, D. (2014). *Armed and dangerous? UAVs and U.S. Security.* RAND Corporation.

Drone Wars (n.d.). Drone crash database. https://dronewars.net/drone-crash-database/

Erdem, A. K. (2022, October 31). Drone, askerin standart demirbaşı arasına girdi. https://www.indyturk.com/node/570496/haber/drone-askerin-standart-demirbaşı-arasına-girdi-doğudaki-bütün-karakollarda-drone

Fogel, B. & Mathewson, A. (2021, February 10). The next frontier in drone warfare? A Soviet-Era crop duster. https://thebulletin.org/2021/02/the-next-frontier-in-drone-warfare-a-soviet-era-crop-duster/

Fuhrmann, M. & Horowitz, M. C. (2017). Droning on: Explaining the proliferation of unmanned aerial vehicles. *International Organization, 71*(2), 397-418.

Fuhrmann, M., Horowitz, M. C., Kreps, S. E. (2016). Separating fact from fiction in the debate over drone proliferation . *International Security, 41*(2) 7-42.

Fukuyama, F. (2021, April 5). Droning on in the Middle East. https://www.americanpurpose.com/blog/fukuyama/droning-on/

Gady, F. S. (2019, November 22). Useful, but not decisive: UAVs in Libya's civil war. https://www.iiss.org/blogs/analysis/2019/11/mide-uavs-in-libyas-civil-war

Hayrapetyan, T. (2021, September 9). How Ilham Aliyev "Personalizes" the results of the 2020 Artsakh War. https://evnreport.com/politics/how-ilham-aliyev-personalizes-the-results-of-the-2020-artsakh-war/

Hayward, K. (2013). *Unmanned Aerial Vehicles: A new ındustrial system*. Royal Aeronautical Society.

Heyns, C. (2013). *Report of the special rapporteur on extrajudicial, summary or arbitrary*. United Nations.

Hız, H. (2020, February 29). SİHA'lar İdlib harekatını tarihe geçirdi: "Bu inanılır gibi değil, tanksavar kullanmaya kalksanız aylar sürer". https://www.yenisafak.com/dunya/sihalar-idlib-harekatini-tarihe-gecirdi-bu-inanilir-gibi-degil-tanksavar-kullanmaya-kalksaniz-aylar-surer-3527623

Horowitz, M. C. (2016). Public opinion and the politics of the killer robots debate. *Research & Politics, 3*(1), 1-8.

Joshi, S. & Stein, A. (2013). Emerging drone nations. *Survival, 55*(5), 53-78.

Kasapoğlu, C. (2022, October 12). Turkish drone strategy in the Black Sea region and beyond. https://jamestown.org/program/turkish-drone-strategy-in-the-black-sea-region-and-beyond/

Kasapoğlu, C. (2020, October 15). Turkey transfers drone warfare capacity to its ally Azerbaijan. https://jamestown.org/program/turkey-transfers-drone-warfare-capacity-to-its-ally-azerbaijan/

Kasapoğlu, C. (2020, October 30). Analysis - Five key military takeaways from Azerbaijani-Armenian War. https://www.aa.com.tr/en/analysis/analysis-five-key-military-takeaways-from-azerbaijani-armenian-war/2024430

Kemal, L. (2021, November 5). Turkey blamed Syria for a deadly air strike. Its troops blame Russia. https://www.middleeasteye.net/big-story/turkey-syria-russia-troops-blamed-air-strike

Kofman, M. & Nersisyan, L. (2020, October 14). The Second Nagorno-Karabakh War, two weeks in. https://warontherocks.com/2020/10/the-second-nagorno-karabakh-war-two-weeks-in/

Kreps, S. (2013, December 4). Ground the Drones? The real problem with unmanned aircraft. https://www.foreignaffairs.com/articles/2013-12-04/ground-drones

Kreps, S. & Zenko, M. (2014). The next drone wars: Preparing for proliferation. *Foreign Affairs, 93*(2), 68-79.

Lacher, W. (2020). *Libya's fragmentation: Structure and process in violent conflict.* Bloomsbury.

Lewis, M. W. (2013, August 21). Drones: Actually the most humane form of warfare ever. http://www.theatlantic.com/international/archive/2013/2008/drones-actuallythe-most-humane-form-of-warfare-ever/278746/

Mayer, M. (2015). The new killer drones: understanding the strategic implications of next-generation unmanned combat aerial vehicle. *International Affairs, 91*(4), 765-780.

Majumdar, D. (2013, November 13). Air force future UAV roadmap could be released as early as next week. http://news.usni.org/2013/2011/2013/air-force-future-uav-roadmap-released-early-next-week

McGarry, B. (2015, February 13). Fewer than 10 drone pilots to receive $1,500 monthly bonus this year. http://www.military.com/daily-news/2015/02/13/fewer-than-10-pilots-to-receive-monthly-bonus-incentive.html

Militarynyi (2022, June 7). Turkey starts mass production of Bozok munition for Bayraktar TB2 UAV https://mil.in.ua/en/news/turkey-starts-mass-production-of-bozok-munition-for-bayraktar-tb2-uav/

Military Today (n.d.). Buk Medium-range air defense missile system. https://www.militarytoday.com/missiles/buk.htm

Military Today (n.d.). Strela-10 Short-range air defense missile system. https://www.militarytoday.com/missiles/strela_10.htm

Miron, M. & Thornton, R. (2020, December 7). Russia's 'revenge' after Nagorno-Karabakh: Reprisals in Syria for Turkey's support of Azerbaijan. https://defenceindepth.co/2020/12/07/russias-revenge-after-nagorno-karabakh-reprisals-in-syria-for-turkeys-support-of-azerbaijan/

Missile Threat (2021, July 6). Pantsir S-1,' *Missile Threat: CSIS Missile Defense Project*. https://missilethreat.csis.org/defsys/pantsir-s-1/

Nicholson, D. (2020, March 2020). Revolutionary' warfare or good marketing: Turkey's Syria drone strikes. https://www.defenceconnect.com.au/strike-air-combat/5709-revolutionary-warfare-or-good-marketing-turkey-s-syria-drone-strikes

Oryx (2020, September 27). The fight for Nagorno-Karabakh: Documenting losses on the sides of Armenia and Azerbaijan. https://www.oryxspioenkop.com/2020/09/the-fight-for-nagorno-karabakh.html

Pack, J. & Pusztai, W. (2020). *Turning the tide: How Turkey won the war for Tripoli.* Middle East Institute.

Parachini, J. V. & Wilson, P. A. (2020, July 2). Drone-era warfare shows the operational limits of air defense systems. https://www.rand.org/blog/2020/07/drone-era-warfare-shows-the-operational-limits-of-air.html

Pitel, L. & Jalabi, R. (2022, August 25). Fast, cheap, deadly: The budget drone changing global warfare. https://www.ft.com/content/948605a1-cf6c-40ea-b403-9a97d72be2cf

Reuters (2015, October 19). Turkish PM Davutoglu says downed drone was Russian-made: TV. https://www.reuters.com/article/us-mideast-crisis-syriaturkeyidUSKCN0SD12620151019

Rogers, J. (2020). What has been the most significant development in the history of weaponry?. *BCC History Magazine*.

ROKETSAN (n.d.). Precision guided missiles: MAM-L smart micro munition. https://www.roketsan.com.tr/uploads/docs/kataloglar/ENG/1628389063_mam-l-en.pdf

SDE (2022, December 14). Korgeneral Bahtiyar Ersay, Azerbaycan ordu üniforması giyerek görevine başladı. https://www.sde.org.tr/azerbaycan/korgeneral-bahtiyar-ersay-azerbaycan-ordu-uniformasi-giyerek-gorevine-basladi-haberi-29330

Shaikh, S. & Rumbaugh, W. (2020). *The air and missile war in Nagorno-Karabakh; Lessons for the future of strike and defense*. CSIS.

Singer, P. W. (2009). *Wired for War: The robotics Revolution and Conflict in the 21st Century*. Penguin.

Spencer, J. & Ghoorhoo, H. (2021, July 14). The battle of Shusha City and the missed lessons of the 2020 Nagorno-Karabakh War. https://mwi.usma.edu/the-battle-of-shusha-city-and-the-missed-lessons-of-the-2020-nagorno-karabakh-war/

Sternstein, A. (2015, April 29). How to hack a military drone?. http://www.defenseone.com/technology/2015/04/how-hack-military-drone/111391/

Stulberg, A. (2007). Managing the unmanned revolution in the U.S. Air Force. *Orbis, 51*(2), 251-265.

Suciu, P. (2020, October 5). Does the Nagorno-Karabakh conflict prove the tank is toast? https://nationalinterest.org/blog/buzz/does-nagorno-karabakh-conflict-prove-tank-toast-170155

TRHABER (2023, August 22). Libya'da HİSAR-O fotoğrafı: Humus Limanı iddiasından sonra şimdi Vatiyye! https://www.trhaber.com/dunya/libya-da-hisar-o-fotografi-humus-limani-iddiasindan-sonra-h121318.html

TUBİTAK SAGE (n.d.). BOZOK laser guided miniature munition. https://www.sage.tubitak.gov.tr/sites/images/sage/bozok.pdf

Turkish National Defense Ministry (n.d.). Bahar Kalkanı Harekatı. https://www.msb.gov.tr/BaharKalkani

UAWIRE (2020, March 11). Erdogan: Turkish Army has destroyed 8 Russian Pantsir air defense systems in Idlib. https://www.uawire.org/erdogan-turkish-army-has-destroyed-8-russian-pantsir-air-defense-systems-in-idlib#

United Nations (2019, November 18). Foreign involvement in Libya must be stopped, top official tells security council, describing 'race against time' to reach peaceful solution, spare lives. https://press.un.org/en/2019/sc14023.doc.htm

United Nations Security Council (2020, January 15). United Nations Support Mission in Libya. Report of the Secretary-General. https://unsmil.unmissions.org/sites/default/files/sg_report_to_sc_15_january_2020_eng.pdf

Urcosta, R. B. (2020). The revolution in drone warfare: The Lessons from the Idlib DeEscalation Zone. *Journal of European, Middle Eastern, & African Affairs, 2*(3), 50-65.

Wallace, B. (2020, July 15). Defence Secretary Ben Wallace gives a speech at the Air and Space Power Conference. https://www.gov.uk/government/speeches/defence-secretary-ben-wallace-gives-a-speech-at-the-air-and-space-power-conference

Wintour, P. (2020, January 5). Turkish troops deploy to Libya to prop up embattled government. https://www.theguardian.com/world/2020/jan/05/turkish-troops-deploy-to-libya-to-prop-up-embattled-government

Witt, S. (2022, May 9). The Turkish drone that changed the nature of warfare. https://www.newyorker.com/magazine/2022/05/16/the-turkish-drone-that-changed-the-nature-of-warfare

Yanık, T. (2022, August 25). Millî SİHA Bayraktar TB2, 500 bin uçuş saatini tamamladı. https://www.aa.com.tr/tr/bilim-teknoloji/milli-siha-bayraktar-tb2-500-bin-ucus-saatini-tamamladi/2669040

Yeni Şafak (2017, August 21). TSK'da yeni dönem silahlı İHA eğitimi başladı. https://www.yenisafak.com/gundem/tskda-yeni-silahli-iha-egitimi-basladi-2783180