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How a Turkish-Built Drone Became an Overnight Game-Changer

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Bayraktar: How a Turkish-built Drone Became an Overnight Game-changer

INTRODUCTION

The recent emergence of drones as an instrument of offensive military power has caused a shift in the power dynamic between actors that possess the ability to generate air power in a traditional sense and those entities that were historically unable to do so. Advancements in drone technology and the use of drones becoming more widespread among nations has caused an evolution in warfare since the beginning of the millennium and ushered in a new era of warfighting strategy. Aside from the traditional world's great powers, and their established strategies surrounding the use of drones and associated technology, Turkey has emerged recently as a new powerful entity in the drone sphere with the development and proliferation of the Bayraktar drone. This paper will discuss how a Turkish-built drone became an overnight global game-changer and resulting considerations for the future battlefield.

Background

Drones, also known as Unmanned Aerial vehicles (UAVs), or remotely piloted aircraft (RPAs) emerged onto the world's battlespaces in the 1980s beginning with technology used primarily for surveillance and intelligence gathering. Prior to this period of advancement, unmanned aircraft use was limited due to the computing power of control systems and associated technology.[1] The advantage that drones offer of having no human life at risk in contested airspace while enabling long-duration flight and extended

[1]Brian Preble, "A Case for Drones," *Technology and Engineering Teacher* 74, no. 7 (04, 2015): 24. Last accessed 22 Apr 2022. https://www.proquest.com/scholarly-journals/case-drones/docview/1677224159/se-2?accountid=9867.

loiter times caused drone technology to proliferate to those powers that were able to construct and operate them. Countries such as the United States of America, Israel, Iran, among others were all active in the development of drone technology and their early use.[2] The resoundingly successful use of drones by Israel against Syria in the 1982 resulted in the downing of a reported 86 Syrian Air Force aircraft in short order over the Bekaa Valley with minimal losses. The attitude towards UAVs changed with the Israeli Air Force's stunning victory and the coordinated use of manned and unmanned aircraft. Israeli drones were used as electronic decoys, electronic jammers and provided real-time surveillance. It could be argued that this campaign ushered in the modern era of the UAV.[3]

In each major conflict since, drone technology has been involved and effectively employed. During the two U.S. led Iraq wars, extensive use of this emerging technology occurred and was shown to have profound influence on coalition success. Drone systems that emerged became more widely known such as Predator, Reaper, Global Hawk, and in the case of Canada, the Heron. The progression towards drones that could fly higher, farther, loiter for longer, collect more imagery, accomplish more tasks, and carry more payloads was the ongoing theme. Real-time full motion video via satellite feeds became the norm as technology permitted. The United States continued to be one of the forerunners of this technology with names like General Dynamics, Boeing, Northrop-Grumman, and Locked providing the research and development horsepower.

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[2]Warren P. Strobel, "Military Drones Now Common to Over 100 Nations, Report Finds," *Dow Jones Institutional News,* 25 September 2019, 2. Last accessed 28 April 2022, https://www.proquest.com/docview/2297009705?accountid=9867.

[3]Cam Tetrault. "A Short History of Unmanned Aerial Vehicles." Last accessed 9 April 2022. http://www.draganfly.com/news/2009/03/04/a-short-history-of-unmanned-aerial-vehicles-uavs/.

Internationally, several new competitors entered the drone technology race, in addition to the state actors that already existed.

Drone technology evolved from the initial uses of reconnaissance, intelligence gathering, and electronic warfare and decoy/target applications to offensive strike capabilities in the decade of the 1990s and onward into the 2000s.[4] Precision strike munitions and the associated delivery systems are now a common feature of drone employment as well as the capability for target designation for other networked platforms to prosecute.[5] With this evolution, the tendency is for drones to become larger, heavier, more complex and exponentially more costly to develop, acquire, and operate. For example, the Northrop-Grumman Global Hawk, which is strictly an Intelligence, Surveillance, and Reconnaissance (ISR) platform without the ability to deliver munitions, had a recent price of 1.5 billion U.S. dollars for 5 aircraft to be delivered and fielded in 2022.[6] This hefty price tag gets the purchaser an aircraft capable of more than 30 hours of unrefueled flight, at a maximum altitude of 60,000 feet and 14,000 miles of range, however it is apparent that this type of system is beyond the defence budget of many middle and small power nations.[7]

The General Atomics Predator/Reaper series of drones reflects perhaps the most advanced version of modern drones in common use. While there are no doubt newer and

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[4]Brian C. Preble, "A Case for Drones." *Technology and Engineering Teacher* 74, no. 7 (04, 2015): 24. https://www.proquest.com/scholarly-journals/case-drones/docview/1677224159/se-2?accountid=9867.

[5]Branka Marijan, "The Third Drone Age." *Ploughshares Monitor* 41, no. 4 (Winter, 2020): 9,10. https://www.proquest.com/magazines/third-drone-age/docview/2466059429/se-2?accountid=9867.

[6]Seth Frantzman, "NATO's new version of the Global Hawk are doing tests over the Med." Last accessed 24 April 2022. https://dronewars2021.com/2020/06/22/natos-new-version-of-the-global-hawk-are-doing-tests-over-the-med/.

[7]United States of America. United States Air Force. "RQ-4 Global Hawk." Last accessed 9 April 2022 https://www.af.mil/About-Us/Fact-Sheets/Display/Article/104516/rq-4-global-hawk/.

more highly classified UAVs in existence, the Predator/Reaper series is a very capable aircraft that has been instrumental in several recent conflicts.[8] These drones can remain aloft for up to 14 hours (or 40 hours with external fuel tanks fitted), at altitudes up to 50,000 feet and over distances of 1000 nautical miles, with the very important addition of a variety of weapon-carrying ability. As a multi-role drone, the Reaper possesses optics and sensors that allow for an ISR and target designation function, as well as up to 3,800 lbs. of weapon-carrying ability to allow for close air support (CAS) and precision strike roles.[9] As compared to the expensive Global Hawk, the MQ-9 Reaper is a much more reasonable cost of approximately 30 million (2012) U.S. dollars per operating aircraft including the associated ground controlling unit.[10] Given the specifications, it is evident that these drone systems are very capable and technologically advanced, however for the requirements of many nations, they are excessively costly to the point of being cost-prohibitive.

BAYRAKTAR DEVELOPMENT

Turkey's recent entry into the drone technology competition is the Bayraktar series of drones. Like many aerospace designers, Baykar Makina began in 2004 as an initiative of the Turkish government in partnership with an indigenous Turkish manufacturer to produce UAVs.[11] Their product development followed a similar pattern

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[8]Hugh Gusterson, *Drone: Remote Control Warfare* (Cambridge: MIT Press, 2016), 19.

[9]General Atomics Aeronautical. "MQ-9A 'Reaper.'" Last accessed 28 April 2022. https://www.ga-asi.com/remotely-piloted-aircraft/mq-9a.

[10]Winslow Wheeler. "The MQ-9's Cost and Performance." Last accessed 09 April 2022 at https://nation.time.com/2012/02/28/2-the-mq-9s-cost-and-performance/.

[11]Baykar Makina. "Bayraktar TB-2." Last accessed 09 April 2022 https://www.baykartech.com/en/uav/bayraktar-tb2/.

of beginning with drones that merely performed ISR functions to later becoming more advanced and incorporated payloads to include targeting and weaponry.

Baykar first produced the Bayraktar Mini UAV between 2004 and 2007 for the Turkish government to use in the southern regions of Turkey in a predominantly counterterrorism role.[12] The design concept was for short range day and night aerial reconnaissance and surveillance applications and was largely successful with both domestic and international sales. Several upgraded versions followed, and production is ongoing for this miniature but capable UAV.[13]

The most prolific and successful Baykar UAV product has become the Bayraktar TB2. The TB2 is classed as a medium-altitude, long endurance UAV that is able to deliver precision guided munitions. Developed following the prototype-only model TB1, the TB2 made its' debut in 2014 and was fully operational in 2015 with the Turkish Armed Forces.[14] The impressive capabilities of this drone made it a resounding success almost immediately. The TB2 can remain aloft for up to 27 hours and to a maximum altitude of 25,000 feet, while carrying payloads of up to 150 kilograms.[15] These payloads can include an impressive Electro-optical/Infrared (EO/IR) sensor ball suite, and/or a combination of precision laser guided bombs making this drone a capable and formidable force in the modern battlespace.

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[12]Baykar Makina. "Bayraktar TB-2." Last accessed 09 April 2022. https://www.baykartech.com/en/uav/bayraktar-tb2/.

[13]Ibid.

[14]Armed Forces.EU. "Bayraktar TB2." Last accessed 09 April 2022. https://armedforces.eu/air_forces/drone/Bayraktar_TB2.

[15]Baykar Makina. "Bayraktar TB-2." Last accessed 09 April 2022. https://www.baykartech.com/en/uav/bayraktar-tb2/.

In less than ten years, from design to the present, the Bayraktar TB2 has been exported by Turkey to at least 19 countries and used in several conflicts. The reasons for this success can be summarized by three key concepts of the drone system: Capability, Cost, and Customers. First and primarily, the Bayraktar TB2 drone is capable of most or all the requirements of the typical user. Secondly, the system itself is far less costly than other comparable systems that are available at present. A third and final key reason for the popularity of the TB2 is that the Turkish government places few restrictions on where the Bayraktar drones can be marketed and who can purchase these systems, unlike many other drone-producing countries.

Capability

The details of the TB2 drone capability compare favourably to other drone manufacturer's offerings as well as the requirements of the typical user. As stated previously, the TB2 can carry munitions payloads up to 150 kilograms and advanced EO/IR sensor arrays with laser target designator function. This potent combination of capabilities is normally found in much more advanced drone systems and has become the gold standard for modern military drone requirements. An interesting Canadian connection exists with the TB2 and the sensor suite, as many of the original models were equipped with the WESCAM MX-15 EO/IR sensor ball, which is Canadian designed and manufactured.[16] This world-leading technology enables the TB2 to effectively perform intelligence, surveillance, target acquisition, and reconnaissance (ISTAR) missions in

[16]Kelsey Gallagher. "Killer Optics." *Project Ploughshares*, (September 2020). Last accessed 11 April 2022. https://ploughshares.ca/wp-content/uploads/2020/09/TurkeyWESCAMReportSept.2020.pdf.

day, night, and most weather conditions. In this respect, the TB2 meets or exceeds the capability of most other drone systems when comparing platforms.

The inclusion of the WESCAM MX-15 became an issue of international concern when the TB2 was used by Turkey in the Syrian conflict, as well as sold to and used by Libya in that conflict, both of which will be discussed later in this paper. The issue was raised by some in the international community as a question on international arms proliferation and the use of the drones where civilians could be targeted harmed in those conflicts. As signatory to the Arms Trade Treaty, Canada is obligated to prevent the export of military hardware in instances where the use thereof could be contrary to international humanitarian law. The concerns surrounding the inclusion of the WESCAM MX-15 EO/IR sensor ball on the Bayraktar drone and the manner in which the drones were being utilized ultimately resulted in the revocation of the export permit that Canada had issued for that hardware.[17] This arms embargo between NATO allies is an unusual situation and has been challenged by the Turkish authorities. Subsequently, the Bayraktar drones were optioned with an indigenously produced Turkish EO/IR sensor suite during the trade dispute which began in 2020.[18]

The TB2 can carry and deliver a wide array of smart munitions, another key capability of the drones, adding to their popularity among user nations. Bayraktars are equipped with hard points where up to four of the following can be mounted, each with their own unique capabilities:

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[17]Kelsey Gallagher. "Killer Optics." *Project Ploughshares*, (September 2020). Last accessed 11 April 2022. https://ploughshares.ca/wp-content/uploads/2020/09/TurkeyWESCAMReportSept.2020.pdf.

[18]Gokhan Ergocun. "Turkish Defense Industry Moving On Despite Embargoes." Anadolu Agency. Last accessed 28 April 2022. https://www.aa.com.tr/en/azerbaijan-front-line/turkish-defense-industry-moving-on-despite-embargoes/1997685#.

- MAM: MAM-C and MAM-L precision-guided munitions
- L-UMTAS (Long Range Anti-tank Missile System)
- Roketsan Cirit (70mm Missile System)
- TUBITAK-SAGE BOZOK Laser Guided Rockets
- TUBITAK-SAGE TOGAN quad rack of GPS/INS guided 81 mm mortars
- TUBITAK-SAGE KUZGUN Modular joint ammunition
- KUZGUN-TjM Turkish: Turbojet engine variant with range of 245 kilometers
- KUZGUN-SS Turkish: Free Soaring variant with range of 110 kilometers.[19]

This impressive array of armament options allows the TB2 to be a valuable, versatile, and lethal weapon in modern conflict. Mainly produced in Turkey, these munitions are capable of effectively striking hardened targets where precision is required, and at lengthy standoff distances thereby preventing the downing of the drone itself by enemy anti-air systems.

The laser designation feature of the TB2 enables the user to elect to deliver the munitions from onboard stores with pinpoint accuracy, or to designate targets for another platform to strike such as a fighter/bomber type aircraft working in cooperation with the drone. This valuable capability enables the higher-value asset to remain at a safer distance or much higher altitude while having the TB2 use target designation laser technology. This ISTAR ability allows the TB2 to produce a force-multiplying effect in the battlespace. While this is not a unique capability, this level of equipment is normally found on sophisticated and much more expensive drone systems.

[19]For further description of these armaments, see Roketsan Roket Sanayii ve Ticaret A.S. "Precision Guided Systems." Last accessed 24 April 2022. https://www.roketsan.com.tr/en/solutions/precision-guided-systems.

Cost

In considering the factors that have made the Bayraktar drone system such a success, the economical aspect of the drones must also be considered. While many nations desire the capability that an armed drone can offer, few are able to embark on their own research and development drone projects and carry out a successful launch of a system. Noteworthy examples of countries who have developed a home-grown armed drone for exportation include: the USA, Israel, China, and Turkey, among several others.[20] In order to facilitate a comparison, the Bayraktar TB2 can be considered to be a competitor of the MQ-1 Predator drone, manufactured by General Atomics, operated by various armed services of the United States and exported to some of its allies. Both the TB2 and the Predator are considered to be Medium Altitude, Long Endurance (MALE) drone systems and have remarkably similar capabilities and characteristics. For example, each drone has a service ceiling of 25,000 feet, can cruise at speeds around 70 nautical miles per hour, and have endurances of 24 to 27 hours.[21] [22] Each can launch and recover semi-autonomously and can carry EO/IR sensors, laser targeting equipment, and are able to operate at great distances. Both the Predator and the Bayraktar TB2 can carry an assortment of munitions including smart bombs and laser-guided missiles and can deliver them accurately after finding and tracking the target. Each drone system also requires a ground station for control of the aircraft system and two qualified operators.

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[20]Dan Gettinger. "The Drone Databook." *The Center for the Study of the Drone at Bard College.* Washington, D.C. 2019. Last accessed 11 April 2022. https://dronecenter.bard.edu/projects/drone-proliferation/databook/.

[21]Baykar Makina. "Bayraktar TB-2." Last accessed 09 April 2022. https://www.baykartech.com/en/uav/bayraktar-tb2/.

[22]United States of America. United States Air Force. "MQ-1B Predator." Last accessed 22 April 2022. https://www.af.mil/About-Us/Fact-Sheets/Display/article/104469/mq-1b-predator/.

The marked difference between the two systems, and another reason for the popularity and success of the TB2 is the price tag. As discussed previously, expensive systems such as the Global Hawk (300 million, quoted numbers are United States dollars per aircraft and include required ground stations), the MQ-9 Reaper (30 million), and the MQ-1 Predator (40 million)[23] are cost prohibitive for many militaries who seek to have a drone capability. Conversely, the Bayraktar TB2 has a recent publicized sale of 12 drones and 3 ground stations to the Ukrainian defence forces for a total cost of 69 million U.S. dollars in 2019, making the per-unit cost of a comparable drone system about 5 million each, less than one-fifth of the per-unit cost of the General Atomics Predator/Reaper drones.[24]

When comparing the offensive capabilities these drone systems provide to a traditional multi-role strike aircraft with an onboard pilot, the UAV wins every time. Particularly when comparing the cost-effective TB2 to the costs associated with fielding a fighter/bomber aircraft, the human pilot, and the larger aircraft costs significantly more than the drone. The value proposition of the Bayraktar drones is difficult for prospective buyers to ignore.

Customers

Bayraktar Makina has successfully marketed their drone systems to a variety of customers in the brief time of their existence. From a launch in 2014 until present, the

[23]Military Factory. "General Atomics MQ-1 Predator (Predator A), MQ-9 Reaper." Last accessed 11 April 2022. https://www.militaryfactory.com/aircraft/detail.php?aircraft_id=46#:~:text=At%20a%20cost%20of%20about,operations%20in%20Iraq%20and%20Afghanistan.

[24]Elisabetta Confalonieri. "The Turkish Bayraktar TB2: Ankara's Renewed Prominence in the Drone Market." FINABEL European Army Interoperability Centre. Last accessed 11 April 2022 at https://finabel.org/the-turkish-bayraktar-tb2-ankaras-renewed-prominence-in-the-drone-market/.

TB2 drone system has been purchased by at least 19 nations in Europe, Africa, and the Middle East, seemingly unrestrained by the international treaties meant to prevent armaments from flowing into the hands of what could be considered "problematic" countries or governments with poor human rights track records. As quoted by Middle East watchdog group Al Monitor, "several factors have fueled appetite for the Turkish combat drones…absence of any pre-conditions or human rights restrictions limiting their use; and absence of delays such as parliamentary approval."[25] Additionally, controversy regarding the use of Bayraktar armed drones in the region of Ethiopia forced the Turkish Embassy to be moved to adjacent Kenya for the safety of embassy personnel. It would seem as though the accessibility of the Bayraktar drones to any government that wishes to purchase them can be considered at least part of their success.

BAYRAKTAR IN OPERATIONS

The Bayraktar drones have seen operational use during several conflicts in the short time since their development in 2014. The drones have been used extensively in the ISR role in several conflicts. Additionally, once fitted with armament in 2015, the TB2 model became an effective offensive tool on the modern battlefield, striking targets with precision from stand-off distances with remarkable success. What is known regarding the use of Bayraktar drones is that they have been used by the Turkish military in their own conflicts, as well as several of their export customers in various regional conflicts. The Turkish military first used the TB2 as a strike asset during counterinsurgency operations against the Kurdistan Workers' Party (PKK) and People's Protection Units (YPG)

[25]Fehim Tastekin. "Ripple Effects from Drone Sales Force Turkey to Move Ethiopian Embassy." Al Monitor. Last accessed 11 April 2022. https://www.al-monitor.com/originals/2022/01/ripple-effects-drone-sales-force-turkey-move-ethiopian-embassy.

militants' positions across the border in Iraq and Syria in 2018.[26] Subsequently, the drones saw combat use in Libya during the struggle for power between rival factions in that dispute.[27] The third conflict with recorded use of Bayraktar drones in combat occurred between Azerbaijan and Armenia in 2020, followed by the drones again being employed by Ethiopia against Tigrayan forces, also in 2020.[28] At the time of writing, Bayraktar drones are also reportedly being used by Ukrainian forces to counter the 2022 invasion by Russia.[29] These many uses in the Bayraktar's short existence serve to demonstrate the utility of this platform and the revolutionary nature of the TB2 in modern conflict.

Turkey 2017

During counterinsurgency operations the TB2 drones were used extensively in the fight against the Kurdistan Workers' Party (PKK) by the Turkish Armed Forces beginning in 2017. The conflict was reignited in 2015 in the mountainous border regions of southern Turkey and northern Iraq, where the Turkish government attempted to quell the influence of the declared terrorist group of mainly Kurdish fighters. Amid the mountainous terrain and insurgent strongholds, progress was slow to be realized. This changed in 2017 when Bayraktar drones emerged as a useful strike asset against the PKK. Used extensively as an ISR asset, the drones were uniquely able to find and fix the

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[26]Berkay Mandiraci. "Turkey's PKK Conflict: A Regional Battleground in Flux." *International Crisis Group* (2022). Last accessed 24 April 2022. https://www.crisisgroup.org/europe-central-asia/western-europemediterranean/turkey/turkeys-pkk-conflict-regional-battleground-flux.

[27]Ibid.

[28]Agrawal Subhash. "Foreign Drones Tip the Stability in Ethiopia's Civil Conflict." *Report Wire* (2022). Last accessed 25 April 2022. https://www.reportwire.in/foreign-drones-tip-the-balance-in-ethiopias-civil-war/.

[29]Derek Gatopoulos and Susan Fraser. "Cheap but lethal Turkish drones bolster Ukraine's defenses." AP News. 17 March 2022. Last accessed 24 April 2022. https://apnews.com/article/russia-ukraine-middle-east-africa-libya-europe-ecb9e820ea4bddb4464d7e8cb40e82fc.

locations of the enemy despite the difficult terrain. Strikes were then conducted using the TB2 and onboard munitions or coordinated with multi-role fighter aircraft of the Turkish Air Force. As Turkish analyst Berkay Mandiraci notes, "The deployment of Turkish-made Bayraktar TB2 drones since 2017 has proven a game changer for Ankara, providing both armed overwatch for Turkish forces and enabling the targeted killing of higher-ranking PKK figures in hard-to-reach terrain…"[30]

Several indicators of progress can be noted in this conflict and attributed to the use of the Bayraktar drones. Turkish forces were successful in pushing the PKK militants south into the border regions in Iraq while utilizing the sophisticated sensors onboard the TB2 to locate high ranking insurgents and prosecute strikes well into Iraqi territory. Prior to using the Bayraktars, Turkey employed drones made in Israel or the United States which were less sophisticated and more expensive surveillance assets only. With the use of the TB2, armed overwatch of friendly troops for lengthy periods of time became possible which anecdotally increased morale and the confidence of Turkish troops.[31] This can be considered an indirect effect and a benefit to the use of this new technology.

The TB2 drones made use of the 27-hour endurance and loiter capability mentioned previously to enable data collection and target development to a level not previously possible. Better surveillance also increased the number of successful strikes against PKK commanders in the contested regions, with targeted strikes from the armed drones proving to be an essential force enabler. According to International Crisis Group,

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[30]Berkay Mandiraci. "Turkey's PKK Conflict: A Regional Battleground in Flux." *International Crisis Group* (2022). Last accessed 24 April 2022. https://www.crisisgroup.org/europe-central-asia/western-europemediterranean/turkey/turkeys-pkk-conflict-regional-battleground-flux.

[31]Ibid.

the ratio of casualties suffered by the PKK insurgent group versus those suffered by Turkish State security force personnel has risen fourfold in Turkey's favour since 2015.[32] PKK militants are now largely engaged by security forces well inside Iraq and Syrian territory and have been effectively routed from Turkish regions. This progress is attributable to many factors, and most certainly the Bayraktar drones were a contributor to the successes with their ability to find, fix, and strike entrenched insurgents in the difficult terrain.

Libya 2019

Another notable use of the Bayraktar TB2 drone as in the battle for control of Libya. After years of instability caused mainly by the ouster of Muammar Gaddafi by western alliance forces, the Tripoli-based Government of National Accord (GNA) formed as the UN-sanctioned interim government of Libya in 2015 led by Fayez al-Sarraj.[33] This government came under attack by opposing forces from the eastern portions of the country who sought to seize control of the weakened government with the backing of various international supporters such as Russia and the United Arab Emirates. Based in Tobruk, Libyan National Army (LNA) leader General Khalifa Haftar refused to endorse the GNA as legitimate government and launched attacks in a campaign to take over Tripoli and the seat of power within the country.[34] Cities, oil production facilities, ports,

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[32]Berkay Mandiraci. "Turkey's PKK Conflict: A Visual Explainer." *International Crisis Group.* Last accessed 24 April 2022. https://www.crisisgroup.org/content/turkeys-pkk-conflict-visual-explainer.

[33]United Nations Security Council. "Resolution 2259 (2015)." 23 Dec 2015. Last accessed 24 April 2022. https://web.archive.org/web/20160130034711/http://www.un.org/press/en/2015/sc12185.doc.htm.

[34]Shaul Shay. "The Escalation of the War in Libya." *Research Institute for European and American Studies* (21 December 2019). Last accessed 24 April 2022. https://rieas.gr/images/editorial/shaulshaydec19.pdf.

and the country's population were split between the two rival factions even though the GNA was the sanctioned government.

The two leaders, Fayez al-Sarraj, prime minister of Tripoli based GNA, and General Haftar met repeatedly in reported attempts to hold an election between the competing governments. While talks stalled, conflicts over control of oil fields and production continued with the forces from Tobruk taking control over the majority of the country's economic resource, the oil fields.

As the conflict escalated prior to the end of 2019, it became known that the forces of the LNA were being supported to ever-increasing levels by Russia, the United Arab Emirates, Egypt, and Saudi Arabia. These countries had provided arms, fighter and other types of aircraft, military equipment, and in the case of Russia, mercenaries.[35]

The UN-recognized government of the GNA were supported primarily by Turkey and Qatar with personnel, arms, and military equipment. Conveyed along with the recognition of the United Nations, the GNA was seen by the majority of the world's nations as the legitimate government in Tripoli. Turkey was a key ally as the two countries shared many economic ties with significant investment and a large Turkish workforce existing in the Libyan oil resource sector.[36]

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[35]Shaul Shay. "The Escalation of the War in Libya." *Research Institute for European and American Studies* (21 December 2019). Last accessed 24 April 2022. https://rieas.gr/images/editorial/shaulshaydec19.pdf.

[36]Péter Selján. "Military Intervention and Changing Balance of Power in Libya: A Strongman, Russian Mercenaries and Turkish Drones." *Academic and Applied Research in Military and Public* 19, no. 3 (2020): 76.

In April 2019, General Haftar launched a concerted attack on Tripoli with the goal of overthrowing the GNA government. From the spring thru until November, Haftar's forces enjoyed success on the battlefield in their advance, bolstered by the backing of their supporting nations, notably Russian mercenaries, and UAE combat aircraft. After fluctuating levels of support were received from Turkey, the GNA restated their request for military assistance and Turkey answered the call in late November, signing two Memoranda of Understanding (MOU) for military assistance and equipment.[37] The additional military hardware provided by Turkey to the GNA included sophisticated air defence systems, electronic warfare systems, and a fleet of Bayraktar TB2 drones.

The LNA had operationally encircled and laid siege to Tripoli at the time, and the introduction of the Bayraktar proved to turn the tide of the conflict in the GNA's favour. As one writer states: "LNA's goal of seizing the capital abruptly ended after Turkey's intervention with its supply of armed Bayraktar drones."[38] At the time, labeled the "largest drone war in the world" where the Bayraktar was able to find and strike the LNA forces in the desert with ease. The relatively flat, featureless desert terrain of the north and coast means that ground units can be easily spotted, with few places to hide. Bayraktar drones were able to destroy the LNA's ground targets, harass its supply lines, and attack forward air bases that were once considered safe.[39] The TB2 was not immune

[37]Péter Selján. "Military Intervention and Changing Balance of Power in Libya: A Strongman, Russian Mercenaries and Turkish Drones." *Academic and Applied Research in Military and Public* 19, no. 3 (2020): 77.

[38]Alex Gatopoulos. "'Largest drone war in the world': How airpower saved Tripoli." *Al Jazeera online.* 28 May 2020. Last accessed 24 April 2022. https://www.aljazeera.com/news/2020/5/28/largest-drone-war-in-the-world-how-airpower-saved-tripoli.

[39]Ibid.

to the effects of the LNA air defence systems, with 23 GNA drones reported as having been downed during the conflict.[40]

The LNA had enjoyed relative air superiority using UAE-supplied combat aircraft and Chinese made Wing-Loong drones, as well as Russian-made Pantsir air defense systems. These systems eventually fell victim to the Turkish supplied Bayraktar drones and electronic warfare equipment, and the GNA quickly capitalized on the turn of the tide, retaking terrain and airfields while thwarting the LNA's initiatives. By May 2020, the LNA's primary headquarters and supply logistics airfield hub had been retaken by GNA forces, and the Russian mercenaries had been evacuated from the country.[41] The Bayraktar TB2 had participated in the largest drone war in the word and emerged victorious, despite suffering some airframe losses in the process.

Azerbaijan 2020

Another instance of the Bayraktar drone's innovative nature is their use by the forces of Azerbaijan in the decades-long war with Armenia. Following the dissolution of the Soviet Union, Azerbaijan and neighbouring Armenia were left as independent regions who then became locked in a war over territory known as the Nagorno-Karabakh region in the South Caucasus. This area is typified by rugged, forested, and mountainous terrain and the dispute regarding control over the region has existed for more than a century

[40]Al Marsad. "LNA Downs Another Turkish Bayraktar Drone Loaded at Mitiga Airbase." *Almarsad.co.* 31 March 2020. Last accessed 25 April 2022. https://almarsad.co/en/2020/03/31/lna-downs-another-turkish-bayraktar-drone-loaded-at-mitiga-airbase/.

[41]Alex Gatopoulos. "'Largest drone war in the world': How airpower saved Tripoli." *Al Jazeera online.* 28 May 2020. Last accessed 24 April 2022. https://www.aljazeera.com/news/2020/5/28/largest-drone-war-in-the-world-how-airpower-saved-tripoli.

between differing ethnic and political groups. Armenia was occupying the territory of Azerbaijan in a long-standing stalemate. The conflict was anticipated to continue into the foreseeable future. The disputed region had been Azerbaijan territory for approximately a century but there had been a request for its official transfer to Armenian state control. The request for transfer of this territory went through Moscow, who supported Armenia somewhat in their efforts, whereas Azerbaijan found support in other countries but perhaps most importantly, Turkey. This is of course, a simplified version of a long historical dispute with many facets and much nuance.

Over time, Azerbaijan's position strengthened with population and an improving resource-based economy which allowed them to improve their military. Their alignment with Turkey allowed them to purchase Bayraktar TB2 drones and secure the support of Turkey in developing expertise in UAV tactics. The Armenians remained aligned to Russia in purchasing and equipping their military, including drones and air defence equipment. Both sides had UAVs and used them in conflict.[42] Although Armenian ground forces were weaker, the rugged terrain had allowed them to defend the area and were able to stop Azeri military advances to retake territory. This stalemate continued for many years and the conflict continued in varying degrees of intensity.

Bayraktar drones allowed the Azeri to target tanks and artillery, and TB2 drones successfully attacked the Armenian air defence systems relentlessly during a 44-day period of intense fighting. New tactics in the use of UAVs were reported to have been employed as the Azeri forces used ancient Antonov AN-2 biplane aircraft without

[42]Tim Ripley and Samuel Cranny-Evans "Unmanned Strategy: The Fight for Nagorno-Karabakh." *Jane's Defence Weekly.* 12 January 2021. Last accessed 25 April 2022. https://customer-janes-com.cfc.idm.oclc.org/Janes/Display/FG_3863602-JDW.

aircrew as decoys, allowing the Armenian air defence units to engage them and neutralize them. The location of these Armenian air defence sites where then exposed to the Azeri Bayraktar TB2 drones and precision strikes were used to prosecute them with laser-guided munitions.[43] Armenian air search radar were unable to detect the Bayraktar drones to a large extent, resulting in freedom of movement and Azeri control of the air. Without an effective air force or system of air defences, the Armenian ground forces were left exposed and vulnerable. The Armenian tank fleet was quickly destroyed as they had nowhere to hide and no way to counter the enemy from the air.

After decades of conflict in the Nagorno-Karabakh region, the Azeris were able to rout the Armenian forces and reclaim their territory thanks to the skillful and strategic use of the Bayraktar drones. A cease fire was brokered between the two nations in November 2020 ending the conflict.[44]

Ethiopia 2020

For decades, Ethiopia was governed by a ruling coalition of four ethnic-based parties, with the Tigray People's Liberation Front (TPLF) being the dominant party of the four. In 2018, three of the parties merged, led by Prime Minister Abiy Ahmed.
The TPLF declined to join the party and chose to create its own government complete with elections that defied the overall rule of Abiy's party and intensified the dispute.

[43]Tim Ripley and Samuel Cranny-Evans "Unmanned Strategy: The Fight for Nagorno-Karabakh." *Jane's Defence Weekly.* 12 January 2021. Last accessed 25 April 2022. https://customer-janes-com.cfc.idm.oclc.org/Janes/Display/FG_3863602-JDW.

[44]Ibid.

The TPLF attack on a federal military base in Tigray lead to outright conflict between the insurgents and Abiy's government forces.[45]

What followed was a 13-month war with Tigrayan rebels, culminating in November 2020 when Prime Minister Ahmed launched a major offensive against the rebels making their way to the capital of Addis Ababa. The advancing column of fighters and equipment were met with precision strikes from Bayraktar TB2 drones, stopping the convoys in their tracks approximately 80 miles from the capital. As one writer noted the drones had a profound impact on this conflict: "pummeling Tigrayan rebels and their supply convoys as they pushed down a major highway toward the capital, Addis Ababa. The rebels have since retreated roughly 270 miles by road to the north, erasing months of battlefield gains."[46] The same writer also provides this quote following the dramatic turnaround of the conflict: "Tigray leader, Debretsion Gebremichael, told the United Nations he had ordered an immediate withdrawal of all forces to the borders of Tigray, citing, among other factors, 'the drones provided by foreign powers.'"[47]

This conflict had regional significance as an unstable government in Ethiopia threatens to destabilize the entire Horn of Africa region. Ethiopia serves as a stabilizing force for surrounding countries Sudan and Somalia, having the country embroiled in an ongoing civil war could prompt a massive and destabilizing refugee crisis in the region.[48]

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[45]Michelle Gavin. "The Conflict in Ethiopia's Tigray Region: What to Know." *Council on Foreign Relations* (2021). Last accessed 24 April 2022. http://www.jstor.org/stable/resrep31163.

[46] Agrawal Subhash. "Foreign drones tip the stability in Ethiopia's civil conflict." *Report Wire* (2022). Last accessed 25 April 2022. https://www.reportwire.in/foreign-drones-tip-the-balance-in-ethiopias-civil-war/.

[47]Ibid.

[48]Michelle Gavin. "The Conflict in Ethiopia's Tigray Region: What to Know." *Council on Foreign Relations* (2021). Last accessed 24 April 2022. http://www.jstor.org/stable/resrep31163.

The effective use of armed Bayraktar drones significantly contributed to the end of this rebel advance and prevented large-scale prolonged conflict and suffering in the Horn of Africa region that would result from an overthrown government in Ethiopia.

Ukraine 2022

At the time of writing, the war between Russia and Ukraine is ongoing with both sides suffering heavy losses in personnel and equipment. The invasion of Ukraine territory has been capably met by the overmatched Ukrainian forces with international support and the use of Bayraktar TB2 UAVs. Notably, the Russian military has become stalled on several advances as their supply lines and armoured columns fall victim to precision strikes by Ukrainian drones.[49] The drones have also been used in the information war that is ongoing regarding the conflict, a tactic not previously seen. Social media posts abound with video footage of precision strikes on Russian military equipment and serve as morale-boosting rallying cries for Ukrainian and international support.[50] Also notable in this conflict is the successful use of drones against a modern military force with advanced air defence equipment that should be capable of countering

[49]Derek Gatopoulos and Susan Fraser. "Cheap but lethal Turkish drones bolster Ukraine's defenses." *AP News.* 17 March 2022. Last accessed 24 April 2022. https://apnews.com/article/russia-ukraine-middle-east-africa-libya-europe-ecb9e820ea4bddb4464d7e8cb40e82fc.

[50]For examples see YouTube: "Russia Ukraine War - Bayraktar TB2 strike Russian forces." Posted by x8hp83," 27 February 2022. https://www.youtube.com/watch?v=elCrMqE9L7s. Also "Drone footage captures strikes on Russian tank in Mariupol, Ukraine." Posted by "news.com.au," 16 March 2022. https://www.youtube.com/watch?v=gXoyWH5FMgU, and "Bayraktar – Official Song (English)." Posted by "Holcicaaak12," 2 March 2022. https://www.youtube.com/watch?v=CXVu_DeB4wo. All last accessed 25 April 2022.

the threat of the TB2. It would seem that the tactics employed by the Ukrainian forces in the use of the drones have been extremely effective in their attacks on the Russians.[51]

FUTURE CONSIDERATIONS

With the recent successes of the Bayraktar drones in high profile regional conflicts, it can be assumed that their proliferation will become more widespread. Owing to their low-cost, advanced technology, and ease of use, they will continue to be sought after by small and middle powers wanting to obtain precision strike capability from the air without the prohibitive cost of fielding an air force with crewed fighter aircraft. Additionally, the sales by Turkey to other nations seems to be unrestricted by global arms sales treaties, making the popularity of the Bayraktar drones increasingly the purview of nations whom other arms-producing countries may not have a desire to deal with.

Implications of unrestricted proliferation include the global need for awareness of drone capabilities and the potential for their use in any active operation, including peacekeeping, by actors formerly unable to generate air power or other air defence systems. Proven to be difficult to detect, the need for counter measures against possible drone attacks becomes an added element in future strategic considerations.

CONCLUSION

Based on the preceding examples, the Turkish built Bayraktar TB2 drone has become a global game-changer in conflict situations. In the cases of Syria, Libya,

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[51]Derek Gatopoulos and Susan Fraser. “Cheap but lethal Turkish drones bolster Ukraine’s defenses.” *AP News.* 17 March 2022. Last accessed 24 April 2022. https://apnews.com/article/russia-ukraine-middle-east-africa-libya-europe-ecb9e820ea4bddb4464d7e8cb40e82fc.

Azerbaijan, and Ethiopia, decades long conflicts were quickly resolved with the employment of TB2 technology. The Bayraktar drones are smaller, cheaper, and equally capable when compared to their larger counterparts and have proven effective without consideration of terrain. As a result, the future battlespace will be increasingly affected by drone technology. Countries making use of such weapons will continue to enjoy a force multiplying and force enabling asset. Combatants that do not possess drone strike capability and effective counter-drone technology will fight at an increasing disadvantage, and those that do not pay attention to this lethal threat and proliferation of the threat do so at their own risk.

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