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# Turkey as a Drone Superpower: A Case Study of a Mid-Size Power Driving the Operational Environment

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FMSO has provided some editing, format, and graphics to this paper to conform to organizational standards. Academic conventions, source referencing, and citation style are those of the author.

The views expressed are those of the author and do not represent the official policy or position of the Department of the Army, Department of Defense, or the U.S. government.

# **Turkey as a Drone Superpower: A Case Study of a Mid-Size Power Driving the Operational Environment**

**Synopsis:** Turkey has emerged as a drone superpower on the world stage. In just the past few years, Turkey has become one of a select group of countries in the world that can produce, use and export armed drones extensively, trailing only the United States, Israel, and China. In addition, it has innovated new ways to use its cost-effective Bayraktar TB-2 to achieve overmatch by emphasizing quantity over quality across an array of battlefields. Turkey's innovative use of drone squadrons as a surrogate for an air force in a conventional battle has provided a strategy for middle-sized powers to emulate, resulting in several such powers—including Ukraine, Poland, Azerbaijan—buying these cost-effective systems from Turkey with a view to do so. Other mid-size countries with limited defense budgets are likely to replicate this approach, changing the nature of local conflicts and even the calculations of larger observing nations. This paper examines Turkey's innovative use of the Bayraktar TB-2 drone, as a case study of how a mid-size power can drive geopolitical outcomes around the globe through drones.

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September 2022

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## 1. Introduction

Turkey has emerged as a drone superpower on the world stage. In just the past few years, Turkey has become one of a select group of countries in the world that can produce, use and export armed drones extensively, trailing only the United States, Israel, and China. In addition, it has innovated new ways to use its cost-effective Bayraktar TB-2 to achieve overmatch by emphasizing quantity over quality across an array of battlefields. Turkey's innovative use of drone squadrons as a surrogate for an air force in a conventional battle has provided a strategy for middle-sized powers to emulate, resulting in several such powers—including Ukraine, Poland, Azerbaijan—buying these cost-effective systems from Turkey with a view to do so. Other mid-size countries with limited defense budgets are likely to replicate this approach, changing the nature of local conflicts and even the calculations of larger observing nations. This paper examines Turkey's innovative use of the Bayraktar TB-2 drone, as a case study of how a mid-size power can drive geopolitical outcomes around the globe through drones.

This paper focuses specifically on the Bayraktar TB-2 drone, which has been called “the Kalashnikov of the 21<sup>st</sup> century,” a reference to the AK-47 rifle created by the Soviet Union that changed the course of military history by flooding war zones due to its ease of use and low cost.<sup>1</sup> The Bayraktar TB-2 is a Turkish medium-altitude long endurance (MALE) unmanned combat aerial vehicle (UCAV) capable of remotely controlled or autonomous flight operations. It is relatively small, with a low radar cross-section and lower flight speed, making it difficult for radars to detect.<sup>2</sup> It is manufactured by Turkey's Baykar company, primarily for the Turkish Armed Forces. Turkey credits its development to MIT-educated engineer Selçuk Bayraktar, who is President Erdoğan's son-in-law.



Image: The Bayraktar TB-2

Source: Army.com.ua, via Wikimedia

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Through the cost-effective Bayraktar TB-2, Turkey achieved a very delicate balance between cost and performance/technology. This enabled the Turkish Armed Forces to deploy large numbers of them and effectively use them as a mobile air artillery in conventional battles, achieving overmatch by using quantity over quality. By using these armed drones as the primary element in air strikes, the Turkish military changed the course of many conflicts.

## Bayraktar TB-2 Basic Flight Performance

Width/Wingspan: 39.4 ft (12.0 m)	Cruising Speed: 70 knots
Length: 21.3 ft (6.5 m)	Maximum Speed: 120 knots
Height: 7.2 ft (2.2 m)	Endurance: 27 hours
Max Takeoff Weight: 1543 lb (700 kg)	Ceiling: 24,000 ft (7,320 m)
Payload Capacity: 330 lb (150 kg)	Engine Power: 100 hp

Source: The website of Baykar Makina, *Baykartech.com*. <https://baykartech.com/en/uav/bayraktar-tb2/>

## 2. Turkey's Use of Bayraktar TB-2s: A New and Innovative Use of Drones

The Turkish military first deployed this tactic in late February-early March 2020, during Turkey's "Operation Spring Shield" in Syria, where it used drone squadrons as an air force in a conventional battle for the first time.<sup>3</sup> Turkish defense experts claimed to have written military history, noting that Turkey's use of drones as a "mobile air artillery" was unprecedented.<sup>4</sup> This tactic allowed armed drones to shine as an instrument that gets results even when facing advanced air defense systems, and it triggered a debate about whether the tactic is transforming the battlefield.<sup>5</sup>

The goal was to push back Syrian regime elements in Idlib in response to an air strike against Turkish units, which killed 33 Turkish soldiers on 27 February 2020. Turkish military planners opted to use drones because Russia's denial of the airspace created grave risks for manned aircraft. The Turkish military had to operate within the engagement boundaries of the Syrian Russian-made Pantsir SAM systems.

The TB-2 drones carrying indigenous hardware such as MAM-L and MAM-C laser-guided smart munitions systems acted as forward observers, forward air controllers, and hunters all at once, conducting intelligence-surveillance-reconnaissance (ISR), target detection and marking for shooting missions and assault. This was coupled with artillery and rocket fire support, electronic warfare elements, and made possible by a network that allows elements in the operation to exchange real-time information with the command-and-control centers and headquarters. The coordination between drones, artillery units, air force units, ground forces, and special forces in a networked, simultaneous manner was a new strategy that was executed in Syria for the first time and later replicated in Libya and Nagorno-Karabakh.

In "Operation Spring Shield" the drones destroyed dozens of T-55, T-62, T-72 main battle tanks, BMP-1 infantry fighting vehicles, and ZSU-23 Shilka short-range air defense systems, and 2S1 and 2S3 self-propelled howitzers.<sup>6</sup> Most notably, they eliminated eight of Syria's Russian-made Pantsir-S1 surface-to-air missiles systems and Buk air defenses.<sup>7</sup>

Turkish losses were minimal, despite Syrian regime forces possessing short-range air defense systems, notably the Pantsir-S and Russian TOR systems. This was due to the KORAL Electronic Warfare (EW) jamming system, which Turkey used to degrade the effectiveness of Syrian air defense radars. The KORAL, which has a range of 124 miles, has support sensors designed to detect and classify other systems in the area, and an electronic attack element designed to jam, deceive, and overload enemy sensors.

This was the largest concentration of drones ever used in this manner before.<sup>8</sup> Turkish sources also claimed that this was the first time a force used drones as the primary element in air strikes.<sup>9</sup> Turkey's use of armed drones in this manner proved that armed drones, when used in a coordinated manner with other elements, like EW, can be effective against expensive air defense systems. In particular, this tactic showed that drone swarms can be a difficult scenario to defend against, even for the most capable air defense systems, including Russia's Pantsirs. An important component of the drone swarms were the indigenous loitering munitions designed to destroy the radars of air defense systems, given their difficulty in being detected by air defense system radars.

### **3. Turkey's Emergence as a Drone Superpower**

The development of the Bayraktar TB-2 drone is part of a greater effort that dates back to the 1990s, when Turkey's modernization and strategic transformation started with a view to become self-sufficient in the defense industry. In the 1990s, the Turkish military initiated a 30-year, \$150 billion military modernization program with \$60 billion allocated for land forces.<sup>10</sup> In line with this vision, the defense industry in Turkey went through a strategic transformation in the 2000s toward becoming self-sufficient. In the past, Turkey used to meet its defense needs entirely through import; but in the last 20 years, Turkey has made it a strategic priority to reduce dependence on foreign weapons and more competitive in the defense industry. Its recent projects include the national combat aircraft project, the national combat ship, national armed drones, and national helicopters. In addition, there is an effort to produce indigenous missile and rocket systems, battleships, and much more. The Turkish defense industry is also trying to get its indigenous main battle tank (the "Altay" tank) to enter mass production, pending the resolution of an engine procurement challenge.

In the last decade, Turkey has made great strides in mass-producing armed and unarmed drones, as well as laser-guided loitering, or "smart," munitions. These indigenous drones have transformed the Turkish Armed Forces' combat capabilities. The munition systems, such as the MAM-L and MAM-C, enable the TB-2 and the satellite-enabled Anka-S to carry out effective strikes, especially against high-value targets. Turkey is currently building a variety of higher end systems which will have advanced payload and sensors, and that will fulfill a multitude of different roles for the Turkish military. It is investing in smarter technologies, heavier platforms, and more innovative concepts for its unarmed systems. It is working on integrating mini drones with larger

drone platforms, as well as in the early stages of integrating air-to-air indigenous missiles with its Akıncı drone, which has a payload of nearly 3000 pounds.<sup>11</sup> Therefore, even as the Bayraktar TB-2 is a unique drone, it likely does not represent the peak of Turkey's drone warfare capacity.<sup>12</sup> The Turkish Armed Forces have also heavily invested in communication, command and control, and intelligence capabilities. One of these systems is the Turkish Armed Forces Integrated Communication System (TAFICS), which has integrated communication between land, naval, and air forces and has capabilities to share data in real time.<sup>13</sup> These investments have gone hand in hand with an effort to bring the military-industrial complex under the government's sway so it can produce the technologies it needs to be active in multiple fronts. These days, Turkey's defense industry is not just an industry that arms the military, it's also an instrument of foreign policy.

#### **4. How Turkey's Use of the Bayraktar TB-2s Impacted Geopolitical Outcomes**

It is in this context that the use of the Bayraktar TB-2 becomes noteworthy. Following "Operation Spring Shield" in Syria and the success of the Bayraktar TB-2s as a mobile air artillery, Turkey continued to use them similarly in other conflicts, with similar results. This had a significant impact on the course of several conflicts and bolstered Turkey's claim to become a regional power. In particular, they Bayraktar TB-2s have played a critical role shaping the outcome of conflicts in Syria, Libya and in the second Nagorno-Karabakh War. They are also playing an important role in Ukraine.

**a. In Syria (August 2016 – Present):** Turkey's military operations disrupted the emergence of a Kurdish autonomous region or state in northeastern Syria. In addition, Turkey prevented and/or delayed Russia's ultimate goal in Syria, which is to see the Baas regime establish full territorial control over Syria. As of September 2022, Turkish military forces' presence in both Idlib and in the north continues to prevent this, although it is uncertain how much longer they can stay there. Finally, Turkey's first-ever use of drone squadrons as an air force in a conventional battle during Operation Spring Shield (February-March 2020) became a tactic that was replicated in the second Nagorno-Karabakh War and will likely continue to be replicated in many more conflicts.

**b. In Libya (January 2020 – Present):** Starting in January 2020, Turkey began supplying the Government of National Accord (GNA) with Bayraktar TB-2s. These Turkish assets neutralized the Libyan National Army's (LNA's) air superiority and allowed the GNA to fully repel the LNA offensive on Tripoli and launch a counteroffensive. Overall, although Turkey lost a significant number of TB-2s in Libya, these losses were mitigated once Turkey established a layered Turkish air defense in western Libya and an effective unified command of the GNA and its allied militias.<sup>14</sup> This coordinated effort, involving air defenses, coordination among infantry units and the employment of drones and other assets, allowed the GNA to effectively push back a strong, drone-heavy LNA offensive on Tripoli in the summer of 2020. The resulting deadlock led to a political process instead of a victory for the Russia-backed LNA forces.



**c. In the Second Nagorno-Karabakh War (September – November 2020):** The Azerbaijani side, equipped and trained to use the Turkish drones-and-fire complex, dominated the Russia-equipped Armenian forces.<sup>15</sup> The Bayraktar TB-2 drones and Turkey's military support to Azerbaijan, in the form of some 150 military officers and advisors, brought about a victory for Azerbaijan. As a result, Azerbaijan regained some of its previously lost territory and now has a border with Iran. Armenia's loss also challenged Russia's sphere of influence/monopoly, and a conflict frozen for 22 years has thawed.<sup>16</sup> This conflict was a case study of how drones and anti-aircraft technologies allowed a small power like Azerbaijan to achieve aerial supremacy and gain a victory to influence the outcome of a conflict. Meanwhile, Turkey was able to steer the outcome in its ally's favor and alter the existing order with its support.<sup>17</sup>

**d. In Ukraine (February 2022 - Present):** Turkish-made Bayraktar TB2 drones are playing a force multiplier role in the Ukraine conflict, although it is too early to tell if they are changing the trajectory of the conflict. In contrast to the other examples, Ukraine is defending its territory in this conflict, as opposed to using the drones as part of an offensive.<sup>18</sup> Additionally, this is the first time the Bayraktar TB-2 system is being tested against Russian systems in the hands of the Russian military.<sup>19</sup> Nevertheless, according to several Turkish defense experts, the way Ukrainian forces have used these drones in the current conflict are marking new chapters in the use of drones in naval warfare, and possibly in anti-submarine warfare.

Turkey's TB-2 drones came under the spotlight early in the conflict when the Ukrainian military released video footage of them destroying Russian tanks. More recently, the TB2 emerged as a key tool in the sinking of the Moskva, either to distract the Moskva when the Ukrainian anti-ship missiles were launched or to pinpoint the exact location of the cruiser in the Black Sea, enabling precision strikes against it.<sup>20</sup> However they were used, it seems they acted as a force multiplier in Ukraine's maritime operations.

In early May, the Ukrainian Air Force staged a raid on the Russian force occupying Ukraine's strategic Snake Island. Turkish-made Bayraktar TB2 drones played an important role by waging a defense-suppression campaign over the island, knocking out at least three air defense systems, two Russian patrol boats and a landing craft along the shore. The attack on Russian patrol boats and a landing craft marked the first successful neutralization of naval vessels by an uncrewed system. Turkish naval expert Tayfun Özberk claims this is the start of a new era in the use of drones in naval warfare.<sup>21</sup>

In 2019, Ukraine purchased 12 TB-2s, and more deliveries have been made since the start of the recent conflict. Although the exact number of TB-2 drones currently in Ukraine's arsenal is not known, experts estimate it to be somewhere between 24 and 40.<sup>22</sup> Turkey and Ukraine have also agreed to develop the Bayraktar drones in Ukraine. Turkey's Bayraktars have allowed Ukraine to

defend itself and helped enable Turkey to bring the two sides together for the Black Sea grain agreement, raising Turkey's profile within NATO and globally.<sup>23</sup> The defense cooperation with Ukraine has also helped Turkey mitigate some of the negative impacts of Western sanctions due to its S-400 purchase from Russia, such as troubles it has in establishing defense relations with countries concerned to make defense agreements with a U.S. sanctioned country.<sup>24</sup>

## **5. The Proliferation of Turkey's Bayraktar TB-2s**

The success of these drones and their cost-effectiveness has opened up a window of opportunity for countries with limited armed forces budgets. In contrast to U.S. and Israeli drones which are too expensive to afford and maintain for countries with limited budgets, Turkish drones have emerged as an attractive alternative.

Baykar has sold its Bayraktar TB-2 armed drone to a number of low and middle-income states around the world. In Europe, Albania, Poland, and Ukraine have purchased them, while others like Lithuania and Romania are eyeing them.<sup>25</sup> In Asia, Kyrgyzstan, Pakistan, and Turkmenistan have acquired them.<sup>26</sup> In Africa, Algeria, Angola, Ethiopia, Morocco, Nigeria, and Rwanda have either purchased or shown interest in buying TB-2 drones.<sup>27</sup> Ethiopia uses the drones in its war against rebel forces from the northern Tigray region.<sup>28</sup> In the Gulf, Qatar has purchased them, while Saudi Arabia has expressed interest.<sup>29</sup> These sales include ground control stations and the training of these countries' air force pilots and maintenance personnel, allowing Turkey to extend its geopolitical influence by using drones as an instrument of foreign policy.

## **6. Implications for U.S. /Partner Security**

Drones and anti-aircraft technologies that merge ISR with strike capabilities are allowing medium powers to achieve aerial supremacy, changing the trajectories of conflicts. The entry barriers to these technologies are falling and they are becoming more powerful at an exponential pace. Medium powers acquiring such technologies can escalate their military activities at a low cost, making it easier for geopolitical issues to turn to war.<sup>30</sup> As Mike Horowitz, Sarah Kreps and Matt Fuhrmann argue, drones lower the costs of using force by eliminating the risk that pilots will be killed, making some states more likely to carry out targeted attacks.<sup>31</sup> Integrating armed drones with loitering munitions and land-based fire-support complexes proved to be a game changer in terms of shaping the outcomes of battles and the ability of outside actors to influence conflicts.

In contrast to the U.S.'s use of drones for targeted attacks against high-target individuals, camps or locations, the use of the Bayraktar TB-2 as part of a modern "reconnaissance-strike complex" points to a future where the United States and its allies will be increasingly challenged by technologies such as capable drones with ISR and strike capabilities. Drones will become autonomous and start to emit no radiofrequency signals, which will make them exponentially

difficult to detect and intercept. TB-2s have reportedly evaded detection by the radar of Russia's *Moskva* flagship in the Black Sea, leading to its sinking and likely changing Russia's calculations in the Black Sea.<sup>32</sup>

This adds some nuance to the broader U.S. threat narrative, which has long focused on the so-called "2+3" threat actors, starting with China and Russia but also including North Korea, Iran, and radical ideologues. Medium powers acquiring cost-effective drone technologies and escalating their military activities means that conflicts can more easily arise in any part of the world, which will complicate the operational environment for the United States. The example of Turkey as a rising mid-size military power with a close nexus to China, Russia, and radical ideologues threats stands out. In all the conflicts noted here, Turkey was challenging Russia. This means that Turkey will have greater ability to either help or hurt U.S. efforts to counter Russia and other adversaries.

## NOTES

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