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# THE DEVELOPMENT OF THE TURKISH ARMED FORCES' PRECISION STRIKE CAPABILITIES THROUGH THE CASE OF THE SYRIAN CIVIL WAR

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ABSTRACT: *By the second half of the 2010s, Türkiye had unquestionably become an unavoidable geopolitical actor not only in the Mediterranean basin but also in the Middle East. Ankara's cultural and economic influence on the Islamic world is by no means negligible; nevertheless, it was most likely the rapid development of military capabilities that captured global attention. One of the earliest and most serious tests of Turkish drone technology was the Syrian civil war, where unmanned aerial vehicles had to operate in close cooperation with ground forces. In this article, the author aims to present the results achieved by Turkish military drones in Syria and examine how these experiences influenced Ankara's military doctrine.*

KEYWORDS: *Middle East, Syrian civil war, unmanned aerial vehicles, military technology, Türkiye*

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## INTRODUCTION

From the 2000s onward, the spread of unmanned aerial vehicles (UAVs) and precision-guided munitions (PGMs) has fundamentally reshaped the character of modern warfare. Drone warfare is no longer the exclusive domain of great powers. Regional middle powers and non-state actors have also become capable of developing strike capabilities that were previously available only to states with the most advanced air forces. In this process, Türkiye has emerged over the past decades as one of the most dynamically developing actors. Relying on drone technology and its defense industry, it has significantly increased its military autonomy and regional influence in the Middle East and several regions of Africa.

The Syrian civil war has become a terrain of particular importance for the Turkish Armed Forces, as it has simultaneously served as a strategic buffer zone, a source of domestic security risks, and an active "experimental laboratory" for new weapons systems. With the appearance of Turkish Unmanned Aircraft Systems (UAS), precision strike capabilities underwent a qualitative leap. The integration of real-time reconnaissance, target designation, and air or artillery strikes made it possible to conduct operations that had previously entailed greater risk, slower reaction times, or dependence on the support of external allies. Türkiye's involvement in Syria, therefore, cannot be understood without reference to drone technology and the associated precision strike capabilities.

The central question of this study is how Turkish drone warfare reshaped the precision strike capabilities of the Turkish Armed Forces during the Syrian civil war, and what military – and to a lesser extent political – consequences followed from the use of these capabilities. Accordingly, the paper first presents the development of Turkish drone technology and the defense industry, and examines how the new platforms and weapon systems were integrated into the Turkish military doctrine. Second, through brief case studies of the major operations in Syria – particularly the interventions carried out in northern Syria –, it analyses the concrete application of precision strikes, the types of targets engaged, and the operational outcomes.

This study applies a qualitative, case-study-based analytical approach. The selection of Afrin (Operation Olive Branch), north-eastern Syria (Operation Peace Spring), and Idlib (Operation Spring Shield) is not intended to provide a comprehensive overview of all Turkish military activities in Syria, but rather to illustrate distinct phases in the evolution of Türkiye's drone-enabled precision strike capability.

The analysis relies primarily on open-source material, including academic literature, policy reports, official statements, and visually documented strike footage. While these sources enable detailed reconstruction of operational patterns and doctrinal trends, they are inherently affected by selective disclosure, propaganda, and post hoc narrative framing by the involved actors. Accordingly, claims regarding effectiveness and impact are interpreted with caution and treated as indicators of relative, rather than absolute, military performance.

The aim of the paper is therefore not to provide an exhaustive damage assessment, but to identify recurring operational logics, learning processes, and doctrinal adaptations that shaped the Turkish Armed Forces' approach to drone warfare during the Syrian civil war.

# THEORETICAL FRAMEWORK

## The Concept of Modern Precision Warfare

Since the end of the Cold War, one of the most important qualitative changes in warfare has clearly been the spread of precision strike capabilities. While for much of the 20th century, artillery and air strikes were primarily directed against area targets – using large numbers of relatively inaccurate shells or bombs –, from the 1991 Gulf War onward, highly accurate weapons employed against specific targets (command-and-control centers, radar stations, armored vehicles, logistical hubs) have increasingly become dominant.[1] The essence of modern precision warfare lies not merely in the use of "more accurate" weapons, but in the integration of reconnaissance, decision-making, and strike execution into a single, unified system – the so-called "kill chain."

Precision-guided munitions are weapons that, through various guidance systems (GNSS[2]/INS,[3] laser designation, infrared or radar homing), are capable of striking very close to a designated target, typically with a circular error of only a few meters.[4] In technical terms,

1 Rossiter – Cannon 2022.
2 Global Navigation Satellite System.
3 Inertial Navigation System.
4 Düz 2020.

PGMs are thus advanced versions of traditional "dumb" bombs and projectiles. The basic munition itself (for example, the American Mk-82/83/84 bomb bodies) may remain unchanged, but by adding a guidance kit (such as JDAM,[5] HGK,[6] KGK,[7] etc.), it is transformed into a "smart" weapon.

Precision strike capabilities, however, cannot exist without extensive intelligence, surveillance, and reconnaissance (ISR) capabilities. ISR systems – satellites, manned aircraft, UAVs, and electronic intelligence assets – provide data necessary for locating targets, tracking enemy movements, and conducting post-strike assessments.[8] In modern warfare, strike operations must therefore be understood not as standalone actions, but as elements of a data-driven operational cycle.

This cycle is captured by the frequently cited concept of the "kill chain" (find–fix–track–target–engage–assess), which frames the process as a sequence: (1) detecting the target, (2) localizing it, (3) continuously tracking it, (4) authorizing engagement, (5) executing the strike, and (6) assessing the results.[9] The effectiveness of precision warfare depends not only on the technical accuracy of the weapon itself, but also on how quickly, reliably, and coherently this entire chain functions – especially in complex theaters of operation, such as Syria.

## Classical Artillery/Air Strikes and Precision Strikes

The logic of classical artillery and air strikes was based on mass and repetition, as heavy-caliber artillery fire or carpet bombing would "blanket" a target area in the hope that the objective was located somewhere within. This approach is problematic not only from a military but also from a political perspective, as the use of less accurate weapons leads to greater collateral damage – including civilian casualties and the destruction of infrastructure –, which can delegitimize operations, especially in densely populated urban environments.

Precision strikes, by contrast, aim to neutralize a specific target (such as a command bunker or an armored vehicle) with minimal expenditure of munitions and the smallest possible amount of collateral damage. Given the high unit cost of precision-guided munitions, the cost-effectiveness of precision warfare can only be ensured if the other elements of the "kill chain" – ISR, communications, and decision-making – also function in close coordination.[10] Precision strikes, therefore, presuppose not only technological but organizational innovation as well, with network-centric command structures, real-time data sharing, and the close integration of different branches of the armed forces (air, ground, and artillery).

It is important to emphasize, however, that precision warfare is not a "magic solution". In practice, informational uncertainty, the deliberate concealment of targets, and the limitations of sensors and data links mean that even a precise weapon does not automatically guarantee an accurate – or legally and ethically flawless – hit. Precision strikes should

[5] Joint Direct Attack Munition.
[6] Hassas Güdüm Kiti – Precision Guidance Kit.
[7] Kanatlı Güdüm Kiti – Wing-Assisted Guidance Kit.
[8] Bakeer 2020.
[9] Deptula 2001.
[10] Rossiter – Cannon 2022.

therefore be understood as a factor that reduces the probability of civilian casualties, rather than one that eliminates that probability.

## Basic Concepts of Drone Warfare

One of the key elements of modern precision warfare is the employment of unmanned aerial vehicles. Collectively, these are referred to as UAVs, or more broadly as UASs (unmanned aircraft systems), a term that also includes the ground control station and the associated communications network.[11] When an aircraft – commonly referred to in everyday language simply as a drone – is equipped not only with reconnaissance capabilities but also with strike weapons, it is often described as a UCAV (unmanned combat aerial vehicle).

In military practice, drones are classified in several ways.[12] One widely used categorization distinguishes systems based on altitude and endurance, separating:

- tactical small, mini, and micro UAVs, which are primarily used for company- or battalion-level reconnaissance, often referred to as Class I UAVs;
- low-altitude, long-endurance (LALE) tactical systems used for brigade-level reconnaissance, referred to as Class II UAVs;
- medium-altitude, long-endurance (MALE) systems, capable of operating at altitudes of 5–10 kilometers with endurance exceeding 20 hours;
- and high-altitude, long-endurance (HALE) platforms, which are mainly suited for strategic reconnaissance missions.[13]

Table 1 *UAV categories based on range*[14]

| Operational levels | UAV Categories | Mass (kg) | Range (km) | Endurance (hrs) |
|---|---|---|---|---|
| Tactical | Micro (μUAV) | ≤ 5 | ≤ 10 | 1 |
| | Mini (MAV) | ≤20/25/30/150 | ≤ 10 | ≤ 2 |
| | Close-range (CR) | 25–150 | 10–30 | 2–4 |
| | Short-range (SR) | 50–250 | 30–70 | 3–6 |
| | Medium-range (MR) | 150–500 | 70–200 | 6–10 |
| | Multi-role endurance (MRE) | 500–1500 | ≥ 500 | 10–18 |
| | Low-altitude deep-penetration (LADP) | 250–2500 | ≥ 250 | 0.5–1 |
| | Low-altitude long-endurance (LALE) | 15–25 | ≥ 500 | ≥ 24 |
| | Medium-altitude long-endurance (MALE) | 1000–1500 | ≥ 500 | 24–48 |

[11] Hegedűs et al. 2023a.
[12] Végh – Daruka 2025.
[13] Soyaltin-Colella – Demiryol 2023.
[14] Daruka – Végh 2025, 317.

| Operational levels | UAV Categories | Mass (kg) | Range (km) | Endurance (hrs) |
|---|---|---|---|---|
| Strategic | High-altitude long-endurance (HALE) | 2500–5000 | ≥ 2000 | 24–48 |
| | Stratospheric (STRATO) | ≥ 2500 | ≥ 2000 | ≥ 48 |
| | Exo-Stratospheric (EXO; E-STRATO) | TBD – to be determined | | |
| Special Task | Unmanned combat aerial vehicle (UCAV) | ≥ 1000 | 150 | 2 |
| | Lethal (LET) | TBD | 300 | 3–4 |
| | Decoys (DEC) | 20–500 | 0–500 | ≤ 4 |

From the perspective of the Syrian theater, the relevance of this categorization lies not in its technical completeness but in its operational implications. The conflict environment favored MALE-class UCAVs, which combined sufficient endurance for persistent ISR with the ability to deliver precision-guided munitions from standoff distances.

Lower-category tactical UAVs primarily supported localized reconnaissance tasks, while HALE systems were largely absent due to political sensitivities and air defense risks. The dominance of MALE platforms such as the Bayraktar TB2 and the ANKA-S thus reflects a deliberate balance between capability, survivability, and escalation control in a congested, multi-actor battlespace.

## Advantages and Limitations of Drone Warfare

Supporters of drone warfare highlight several advantages. First, the use of unmanned systems reduces political risk. Because the loss of one's personnel is absent or minimized, it is politically easier to undertake operations that would be considered too risky if conducted with manned aircraft.[15] Second, drones are capable of remaining over a given area for extended periods of time, which makes them ideal for ISR tasks, target surveillance, and identifying patterns of life. Third, drones offer a relatively cost-effective platform for the employment of precision-guided munitions. Although they carry a smaller payload, their operation and maintenance are cheaper than those of larger combat aircraft.[16]

At the same time, drone warfare faces several limitations. From a technical perspective, MALE and HALE drones are relatively slow and vulnerable to modern air defense systems and electronic warfare. Their data links – especially when not operating via satellite relay – can be jammed or intercepted, potentially leading to loss of control or compromise of collected data. From an operational standpoint, the effective use of drones depends heavily on adequate ground infrastructure, training, and analytical capacity. Data collected by drones are of limited value if not supported by robust processing and decision-making networks.[17]

[15] Düz 2020; Daruka – Végh 2024.
[16] Rossiter – Cannon 2022.
[17] Rosenblatt – Kilcullen 2020.

Finally, drone warfare has sparked serious legal and ethical debates. Some authors argue that the "below-threshold" use of precision, remotely controlled strikes risks normalizing the routine application of military force, as the costs of war become less visible to political decision-makers.[18] Others warn that rhetoric about the "surgical" precision of drones often obscures civilian casualties resulting from intelligence failures, misidentification of targets, or incomplete information.

One of the most frequently voiced concerns regarding offensive drones relates to autonomous decision-making. With the spread of artificial intelligence, the scenario has become conceivable in which UCAVs could independently decide on target identification and, in extreme cases, even on carrying out attacks.

At present, however, it is more realistic to interpret this situation as "autonomous decision support." The essence of so-called "human-in-the-loop" systems is precisely that the operation of the UCAV is continuously monitored by a trained operator, who not only supervises the weapon's use during a given mission but also supports the system during the machine-learning process. Criticisms of this approach are therefore largely identical to those that can be raised with regard to any soldier serving on the front line in practice. Soldiers can, of course, make poor decisions and may commit errors under the intense pressure inherent in combat situations; this, however, is an unavoidable element of warfare.

While legal and ethical debates surrounding drone warfare form an important part of the broader scholarly discourse, this study addresses these questions only insofar as they directly influence operational behavior and political decision-making. A detailed normative or legal analysis of civilian harm, proportionality, or accountability mechanisms falls outside the scope of the present article.

Instead, ethical considerations are treated here as contextual constraints that shape how drone operations are framed, communicated, and justified by state actors, rather than as independent objects of evaluation.

## State Actors and Proxy Warfare in Syria

Due to its multi-actor nature, the Syrian civil war is often interpreted as a proxy war. A proxy war refers to a situation in which one or more states provide military, financial, or political support to local armed groups – militias, rebel factions, or semi-regular forces – in order to pursue their strategic objectives indirectly.[19] In the case of Syria, for example, the Damascus regime was supported by Russia and Iran, while various opposition and Kurdish forces received backing from the United States, Türkiye, and other regional powers. Each actor sought to minimize its own direct military exposure.

A defining feature of proxy wars is the existence of a "principal–agent" relationship between the sponsor and the local partner. The supporting state seeks to steer the proxy in line with its own strategy, but the proxy has its own interests, motivations, and constraints. This often leads to coordination problems, indiscipline, or even divergent objectives, further complicating the dynamics of the battlefield.[20] In the Syrian conflict, multiple competing proxy networks operated in parallel, rendering the situation fragmented and difficult to oversee.

[18] Mumford 2013.
[19] Van Veen 2021.
[20] Soyaltin-Colella – Demiryol 2023.

In this environment, precision warfare – and within it, the use of drones – has gained particular significance. External state actors are able to support their proxies or exert pressure on their adversaries in an "over-the-horizon" manner, while minimizing their own ground presence. Precision strikes carried out by drones can thus be understood as a form of "remote intervention" within the context of proxy warfare.

### Why Does the Syrian Theater Favor the Use of Drones?

The Syrian civil war exhibits several structural characteristics that make it particularly conducive to the use of drones. First, from a geographical and logistical perspective, Syria constitutes a nearby theater of operations for several regional powers. The proximity of Türkiye, Israel, Iraq, and the Mediterranean Sea allows drones to be launched and controlled from national territory or nearby bases, with relatively short flight distances. This reduces operating costs and increases responsiveness.

Second, the multi-layered balance of forces in the conflict – the simultaneous presence of great powers (Russia and the United States), regional actors (Türkiye, Iran, and Israel), and local armed groups – means that a conventional, overt air war would be politically extremely risky. Drones enable states to carry out "limited escalation", conducting precision strikes with relatively low risks to personnel and prestige, while attempting to avoid direct confrontation with the air forces of other states.[21]

Third, the complex urban and semi-urban terrain of the Syrian theater – particularly in areas such as Aleppo, Idlib, al-Bab, or Afrin – favors long-endurance, persistent surveillance and pattern-based target identification. In these environments, drones are capable of locating hidden positions, tunnel networks, mobile missile launchers, or vehicles equipped with improvised explosive devices, and, if necessary, executing precision strikes from the same platform.

Finally, throughout the Syrian civil war, not all actors possessed full-spectrum air defense capabilities. While Damascus and its Russian allies established strong air defense bubbles in certain areas, in other zones – especially during the early phases of the conflict and along peripheral front lines – air defenses were fragmented, incomplete, or outdated. This "patchy air defense map" created opportunities for drones to conduct ISR and strike missions at relatively low risk in specific areas, particularly when combined with electronic warfare and other enabling capabilities.

## THE DEVELOPMENT OF TURKISH DRONE TECHNOLOGY AND THE DEFENSE INDUSTRY

### The Modernization of the Turkish Defense Industry and Its Pursuit of Autonomy

The Turkish drone program did not emerge "out of nowhere" but is closely linked to Türkiye's broader efforts to achieve autonomy in its defense industry. The U.S. arms embargo imposed after the 1974 Cyprus intervention, followed by subsequent export restrictions,

[21] Van Veen 2021.

highlighted Türkiye's long-term dependence on foreign suppliers, particularly in the field of high-technology weapons systems. In response, a strategy began to take shape that the academic literature often describes as oscillating between "defense autarky" and continued dependency. Ankara seeks to maximize domestic added value, while still relying on external technologies for certain key components.[22]

From the 2000s onward – especially under AKP[23] governance –, the defense industry became a priority area of Turkish industrial policy. A corporate ecosystem emerged and steadily strengthened, in which traditional major firms such as ASELSAN, ROKETSAN, and TAI/TUSAŞ were joined by new actors, most notably Baykar and Vestel, as well as smaller, specialized companies (for example, STM, focusing on small loitering munition systems).[24] Baykar grew from a family-owned enterprise and specialized specifically in tactical and MALE-class UAVs (Bayraktar Mini, TB1, later TB2, and Akıncı), while TAI (TUSAŞ) represents the state-owned, large-enterprise model through the ANKA/ANKA-S program.[25]

The logic of drone development fits well with a "do-it-yourself" approach. Difficulties surrounding the procurement of Israeli Heron systems and restricted access to U.S. Predator/Reaper platforms incentivized Türkiye to develop its own niche technology in an area where catching up appeared feasible.[26] In the case of drones, relatively modest capital investment can already yield significant military and political returns – especially if the systems gain real combat experience. In this regard, the Syrian civil war proved to be of decisive importance.

## Major Turkish Drone Platforms and Armament

### *Bayraktar TB2 and ANKA-S as MALE Platforms*

The iconic platform of the Turkish drone arsenal is the Bayraktar TB2, which international scholarship classifies as an MALE UCAV.[27] The TB2 is approximately 6.5 meters long, has a wingspan of 12 meters, and a maximum take-off weight of 650–700 kg, of which around 150 kg can be carried as payload (sensors plus armament).[28] The aircraft is powered by a piston engine – initially Austrian, later Ukrainian, and subsequently of Turkish development – providing an endurance of 22–24 hours at an operating altitude of roughly 5.5–7.6 km (see Table 1). Communication with the ground control station is maintained via a line-of-sight data link, offering an operational range of 150–300 km; in the TB2S variant, satellite (SATCOM) connectivity has also been introduced.[29]

[22] Kurç 2017.
[23] Adalet ve Kalkınma Partisi – Justice and Development Party.
[24] Düz 2020.
[25] Düz 2020.
[26] Rossiter – Cannon 2022.
[27] Düz 2020.
[28] Hegedűs et al. 2023a.
[29] Hegedűs et al. 2023c.

Table 2 *Main parameters of some of the most important Turkish drones and the American MQ-9 Reaper*[30]

| Parameters | Manufacturer | | | |
|---|---|---|---|---|
| | Baykar | | | General Atomics |
| Type | TB2 | TB3 | Akinçi | MQ-9 Reaper |
| Length (m) | 6.5 | 8.35 | 12.2 | 11 |
| Width (m) | 12 | 14 | 20 | 20 |
| MTOW[31] (kg) | 630 | 1450 | 5500 | 4760 |
| Payload (kg) | 55 | 280 | 1350 | 1400+360 |
| Payload – MTOW ratio (%) | 9 | 19 | 25 | 37 |
| Maximum power (kW) | 73.55 | 128 | 2×560 | 671 |
| Engine | Rotax 912 | TEI PD170 | 2×AI-450T | Honeywell TPE-31 |
| Power-to-weight ratio (%) | 11.7 | 8.8 | 20.3 | 14.1 |
| Maximum speed (km/h) | 220 | 300 | 361 | 482 |
| Cruising speed (km/h) | 130 | 232 | 240 | 313 |
| Range (km) | 4000 | 1900 (est.) | 7500 | 1900 |
| Flight time (h) | 20 | 24 | 25 | 14 |
| Maximum flight altitude (m) | 6858 | 7620 | 13,716 | 15,240 |
| Hardpoints | 4 | 6 | 8 | 6+1 |

The TB2's sensor suite consists of an electro-optical/infrared (EO/IR) turret, a laser designator, and a laser rangefinder. Together, these systems provide continuous ISR capabilities while also enabling semi-active laser guidance for the onboard weapons. Hungarian academic literature often describes the TB2 as the "Poor Man's Predator". Although it has limited payload capacity, within its category, it stands out for its exceptional endurance, reliability, and extensive combat experience.[32]

The TAI ANKA-S is the other key MALE platform. The ANKA family was originally developed as reconnaissance UAVs, but the ANKA-S variant is equipped with SATCOM capability and weapons, making it a quasi-strategic UCAV capable of sustained operations at altitudes of around 30,000 feet with an endurance of more than 24 hours.[33] Its payload capacity is greater than that of the TB2 (approximately 200 kg), allowing the integration of a wider range of sensors and weapons. While the TB2 has become decisive at the "tactical-operational" level, the ANKA-S is more closely associated with long-range, deeper ISR and strike missions.

[30] Hegedűs et al. 2023c, 36.
[31] Maximum Take-off Weight.
[32] Hegedűs et al. 2023b.
[33] Düz 2020.

Precision munitions: MAM-L, MAM-C, HGK, LGK

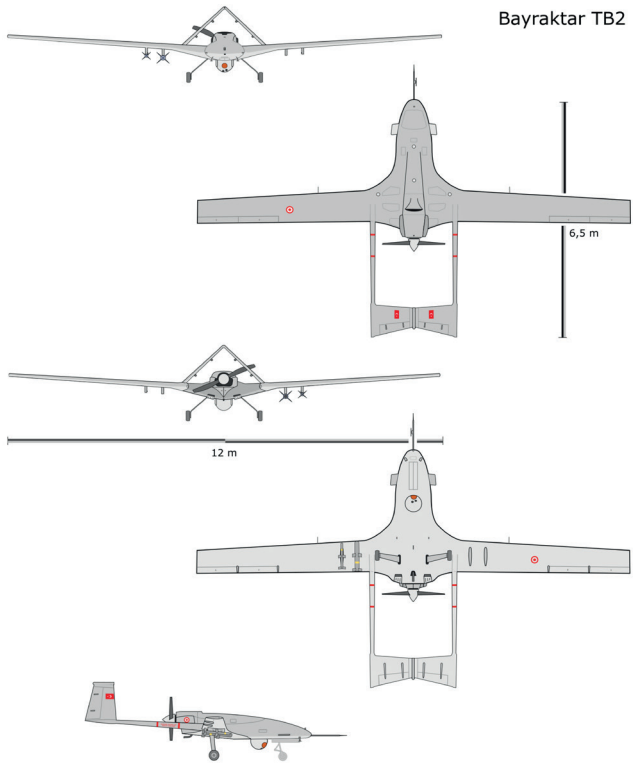



Figure 1 *5-view drawing of a Turkish Bayraktar TB2 tactical drone in flight configuration. The craft is armed with an MAM-L bomb on an inner and an MAM-C bomb on an outer starboard hardpoint*

Source: *Alexpl via Wikimedia Commons*

The success of Turkish drone warfare lies not only in the platforms themselves but also in the family of precision-guided munitions specifically developed for them. The MAM-L and MAM-C micro-munitions (Mini Akıllı Mühimmat – "mini smart munition") developed by Roketsan are weapons optimized in particular for low-payload UCAVs such as the TB2 and ANKA.[34]

The MAM-L weighs approximately 22–23 kg, has a range of 8–14 km, and uses semi-active laser guidance. It is available with several types of warheads, including shaped-charge (HEAT[35]), high-explosive fragmentation, and thermobaric variants. The MAM-C is a smaller munition, weighing around 6–7 kg, with a shorter range but a similar guidance principle, designed primarily for lighter targets such as vehicles, light fortifications, and concentrations of personnel.[36] On the four hardpoints of the TB2, a typical loadout consists of a combination of 2–4 MAM-L and/or MAM-C munitions, allowing a single UCAV platform to conduct precision strikes against multiple targets on one sortie.

[34] Düz 2020.
[35] High-explosive anti-tank.
[36] Düz 2020.




Figure 2 *Turkish MAM-L guided munition*
Source: *Kingbjelica via Wikimedia Commons*

Beyond drones, the Turkish Air Force's traditional bombing capability has also been transformed through the use of precision guidance kits. The HGK-84 kit, analogous to the US JDAM family, converts the 2000-lb Mk-84 bomb into a GNSS/INS-guided, all-weather smart munition with a CEP[37] accuracy of around 10 meters. The KGK wing kit increases the range of Mk-82/83 bombs to up to 100 km, while the LGK[38] laser guidance kit adds semi-active laser homing capability to existing free-fall bombs.[39]

Taken together, these weapon systems enable the Turkish Armed Forces to conduct coordinated precision strikes from different platforms – UCAVs, combat aircraft, and artillery. The TB2 and ANKA-S execute small, "surgical" strikes close to the front line, while bombs equipped with HGK/KGK/LGK kits allow the Turkish Air Force to carry out deeper, higher-intensity strikes as well.

### *Integration into the C4ISR system*

A key feature of Turkish drone warfare is that the TB2 and ANKA platforms do not operate as isolated assets, but as components of a broader C4ISR (Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance) ecosystem. Over the past decade and a half, the Turkish military has gradually built a network-centric command and control system (TAFICS, ADOP-2000), in which various sensors (drones, AWACS,[40]

[37] Circular Error Probable.
[38] Lazer Güdüm Kiti – Laser Guidance Kit.
[39] The latest Turkish defence breakthroughs you need to know about 2018.
[40] Airborne Warning and Control System.

and ground-based radars) and weapon systems (artillery, rocket artillery, and combat aircraft) are linked through a shared information network.[41]

An important element of this system is the KORAL electronic warfare complex, which is capable of jamming and deceiving enemy radars and air defense systems. In the Idlib region of Syria, TB2 and ANKA-S drones were specifically employed in "SEAD-type"[42] operations supported by KORAL. The drones detected and then attacked elements of the Syrian air defense system based on Russian technology (Pantsir, Buk) using MAM-L and MAM-C munitions, while KORAL and other C4ISR assets reduced the effectiveness of enemy countermeasures.[43]

In practice, this means that real-time video and targeting data collected by TB2 and ANKA-S drones are immediately available in joint operations centers, from where fire missions can be assigned to artillery, rocket artillery, or the air force. The drones, therefore, function not only as "flying weapon platforms" but as critical sensor nodes within the kill chain, linking reconnaissance directly to strike execution.

## Doctrinal and Organizational Adaptation of the Turkish Armed Forces

The mass employment of drones within the Turkish Armed Forces required significant doctrinal and organizational adaptation. The experiences of Operation Euphrates Shield (2016–2017) –especially the armored losses suffered during urban combat in al-Bab, the limited availability of close air support, and the threat posed by IEDs[44]/VBIEDs[45] – highlighted that the traditional model based on the triad of air force–artillery–ground forces was, on its own, insufficient against a hybrid adversary.[46]

As a result of these lessons learned, Türkiye accelerated the doctrinal integration of drones. TB2 and ANKA platforms began to be employed not on an ad hoc basis, but in an institutionalized manner. UAV regiments and independent drone bases were established, while dedicated UAV companies were created within the land forces and the gendarmerie. TB2s are now used in parallel by the army, navy, air force, police, and the intelligence service (MIT), indicating that drones have become a genuinely joint, cross-service capability.[47]

The execution of drone operations also requires specialized expertise. A typical TB2 mission is controlled by a three-person crew at the ground control station: a pilot, a sensor/weapons operator (payload operator), and a mission commander. The real-time video and data feed is available not only to this crew but also up the command chain, allowing target designation and fire authorization to be shared both vertically and horizontally. This model proved particularly effective on the Syrian battlefield, where rapidly changing tactical situations demanded a flexible and short "sense–decide–strike" cycle.

In doctrinal terms, the TB2 and ANKA platforms came to be employed in three primary roles:

41 Düz 2020.
42 Suppression of Enemy Air Defense.
43 Ali Bakeer 2020.
44 Improvised Explosive Device.
45 Vehicle-borne Improvised Explosive Device.
46 Yeşiltaş et al. 2017.
47 Rossiter – Cannon 2022, 220–226.

1. ISR platforms, supporting the movement of ground forces, mapping enemy positions, and correcting artillery fire.
2. Precision strike assets, using their own onboard weapons to destroy armored vehicles, artillery systems, and command posts.
3. SEAD roles, operating in coordination with other capabilities (electronic warfare, fighter aircraft) to attack enemy air defense systems.[48]

This threefold role gradually became embedded in Turkish operational thinking, and following the Syrian experience, it has reappeared in other theaters of operation as well – including Libya, Nagorno-Karabakh,[49] and Ukraine.[50]

## THE ROLE OF THE TURKISH ARMED FORCES IN THE SYRIAN CIVIL WAR

### Turkish strategic objectives in Syria

In the initial phase of the Syrian civil war, Ankara's primary objective was regime change. The doctrine of "zero problems with neighbors" was quickly replaced by an approach in which Türkiye sought to act as one of the main supporters of the opposition to the Damascus regime and actively influence the outcome of the conflict.[51] During the 2011–2013 period, Turkish decision-makers assumed that Assad's system would collapse relatively quickly, opening the way for the emergence of an Ankara-friendly, Sunni-dominated political order.

However, the protraction of the civil war, the rise of the Islamic State, and the strengthening of the Syrian Kurdish forces (YPG) gradually transformed Türkiye's priorities. After 2014, the logic of threat management increasingly moved to the forefront, first gradually and then more decisively, guaranteeing the security of border regions, preventing the territorial expansion of organizations linked to the PKK,[52] and addressing the issue of millions of Syrian refugees.[53] A central concept in Turkish discourse became that of the "terror corridor" *(terör koridoru).* Ankara feared that YPG-controlled[54] governorates would become contiguous along the Turkish border, creating a de facto autonomous, PKK-friendly entity in northern Syria.

At the same time, the conflict became ever more closely intertwined with domestic political and security discourse. The anti-PKK operations conducted in Türkiye in 2015, the attempted coup in 2016, and the subsequent "logic of the state of emergency" all contributed to the Syrian war becoming an instrument for maintaining internal order, demonstrating national unity, and restoring the prestige of the armed forces. For the political bloc formed

[48] Kasapoğlu 2020.
[49] Szalkai – Daruka 2022.
[50] Ács 2025.
[51] Siccardi 2021.
[52] Partiya Karkerên Kurdistan – Kurdistan Workers' Party: a political-military entity registered as a terrorist organization by Türkiye, operating mainly in Türkiye.
[53] Van Veen 2021.
[54] Yekîneyên Parastina Gel – People's Protection Forces: a Kurdish armed group operating in northeastern Syria, which Ankara lists as a terrorist organization. The YPG provides the bulk of the armed forces serving under the Syrian Democratic Forces, an opposition to both the Assad regime and – at the time of the writing of this article – the current government.

by the ruling AKP and the nationalist MHP,[55] the military interventions in Syria – especially after 2018 – served simultaneously as a security-policy necessity justified by strategic arguments and as a source of domestic political legitimacy.

Turkish strategic objectives in Syria thus gradually crystallized along three interrelated axes:

1. Counterterrorism, primarily against the structures of the PKK/YPG and the Islamic State.
2. Border security and management of the refugee issue, including the concept of a 30-kilometer-deep "security zone" and plans to resettle part of the Syrian refugee population in northern Syria.[56]
3. Regional influence and status-building, in which Syria became a key arena for Türkiye's middle-power ambitions.

The involvement of the Turkish Armed Forces in Syria can be understood at the intersection of these objectives. Military operations served both immediate security needs (managing threats along the border) and the longer-term foundations of a more assertive, nationalist foreign policy trajectory.[57]

## Major Turkish military operations in Syria

From 2016 onward, Türkiye's intervention unfolded in clearly delineated, named waves of military operations. These operations represent successive phases not only in geographical and chronological terms, but also with regard to the evolving role of drone warfare.

Operation Euphrates Shield was launched by Türkiye on August 24, 2016, and concluded on March 31, 2017. Its official objective was to expel the Islamic State from areas along the Turkish–Syrian border – particularly around Jarabulus, al-Rai, and al-Bab – while simultaneously preventing the linkage of YPG-controlled territories west of the Euphrates.[58] During the operation, regular units of the Turkish Armed Forces, operating in cooperation with Syrian opposition militias (FSA[59]/SNA[60]), recaptured border towns with the support of artillery and air power.

The decisive lesson of Euphrates Shield was that the Turkish military – especially in the vicinity of al-Bab – suffered significant armored and personnel losses as a result of anti-tank guided missiles (ATGMs) and VBIED attacks employed by the Islamic State, while coalition close air support (CAS) was only available to a limited extent. At this stage, drones were used primarily for reconnaissance and fire adjustment; the strike potential of TB2 and ANKA systems was only partially exploited. The operation's after-action report explicitly highlighted the expansion of UAV employment as one of the key lessons for future operations.[61]

[55] Milliyetçi Hareket Partisi – Nationalist Movement Party.
[56] Siccardi 2021; Van Veen 2021.
[57] Siccardi 2021.
[58] Yeşiltaş et al. 2017.
[59] Free Syrian Army: Anti-Assad armed group allied with Türkiye.
[60] Syrian National Army: Anti-Assad militia allied with Türkiye, successor organization to the FSA.
[61] Yeşiltaş et al. 2017, 13–20.

Operation Olive Branch, launched in January 2018, targeted the city of Afrin, which Ankara perceived as a security threat due to the organizational and ideological links between the YPG and the PKK. The objective of the operation was to eliminate the YPG's military presence along the western section of the Turkish–Syrian border and to bring Afrin and its surroundings under Turkish control.[62]

Operation Peace Spring, initiated in October 2019, focused on territories east of the Euphrates in north-eastern Syria, particularly the areas around Tel Abyad and Ras al-Ayn. Its aim was to push the YPG southward away from the Turkish border and establish a 30-kilometer-deep "security zone," which could also serve as a potential area for refugee resettlement.[63]

Peace Spring generated significant international controversy. The partial withdrawal of U.S. forces, security arrangements brokered by Russia, and criticism from the European Union all indicated that Türkiye was pursuing an increasingly autonomous security policy trajectory in Syria – one that at times brought it into conflict even with its allies.[64]

From the perspective of Turkish drone warfare, a true turning point came with Operation Spring Shield in Idlib in February–March 2020. The immediate trigger for the operation was a Syrian regime attack that killed dozens of Turkish soldiers. In response, Ankara launched a large-scale air campaign against regime forces, relying predominantly on drones.

Spring Shield proved successful for Ankara not only in operational terms, but also from doctrinal and reputational perspectives. As will be discussed later, it was during this operation that it became clear to the international community that Türkiye was capable of conducting an integrated precision campaign built around drones against a conventional army, while sustaining a relatively low casualty rate.

## PRECISION STRIKES AND DRONE WARFARE

### Afrin (Operation Olive Branch): target types, fire support, and the role of drones

Operation Olive Branch can be regarded as a transitional phase in the evolution of Turkish drone warfare. Drones were no longer merely "flying cameras," yet they had not become the primary strike instruments of the operation either. Rather, they functioned as key components of an integrated fire support system through which Ankara simultaneously sought (1) to reduce the risks associated with ground advances and (2) to enable more selective, politically defensible use of force.[65]

From an analytical perspective, Afrin represents a transitional phase rather than a fully mature model of Turkish drone warfare. The operation illustrates how UAVs began to move beyond a purely supportive ISR role, yet had not fully assumed the function of primary strike platforms.

[62] The Operation Olive Branch and the US Policy in Syria 2018.
[63] Siccardi 2021.
[64] Siccardi 2021.
[65] Siccardi 2021.

This intermediate character is significant, as it demonstrates the gradual nature of doctrinal adaptation: operational concepts, command-and-control arrangements, and rules of engagement evolved incrementally in response to battlefield experience, rather than through a single, disruptive transformation.

Afrin's terrain and tactical environment were particularly conducive to the ISR functions of drones. On the mountainous, partially forested, and highly segmented terrain, many defensive positions and supply routes could only be identified through prolonged observation. The EO/IR sensors of the TB2 and ANKA platforms – especially the stabilized turrets combined with laser target designators – enabled "pattern-based" intelligence collection – not merely the identification of individual targets, but the detection of movement routines, timing patterns, peaks in vehicle traffic, and concealed logistical links.[66]

Targets in Afrin can be grouped into four complementary categories:

1. Tactical defensive elements: trenches, bunkers, observation posts, and concealed firing positions. While some of these could be neutralized by conventional artillery fire, concealment, camouflage, and proximity to populated areas increased the value of drone-enabled target confirmation and precision strikes (or more accurately directed artillery fire).
2. Logistical lines and nodes: roads, temporary storage sites, vehicle assembly areas, and short-term "distribution points." Although these targets were not necessarily visually striking, they decisively affected the endurance of the defensive system. Here, drones typically appeared in an artillery fire control role, identifying convoys or depots, and then guiding strikes through fire correction.
3. Engineering fortifications and obstacle systems: mined zones, IEDs, rubble, and roadblocks. In these cases, the advantage of drones lies not only in their ability to "see" the terrain, but also in reducing the exposure of reconnaissance patrols by operating ahead of ground forces, thereby assisting engineer units in selecting safer routes.[67]
4. A limited but growing share of direct drone strikes: the Roketsan MAM-L and MAM-C micro-munitions (specifically optimized for MALE/UCAV platforms) appeared in Afrin, not merely in a demonstrative role. Drone strikes proved particularly suitable against targets where artillery posed excessive collateral risk or where rapid, time-sensitive intervention was required (e.g., briefly exposed vehicles or forward observation posts).[68]

In Afrin, therefore, the principal contribution of drone warfare to ground forces lay in achieving superior situational awareness and fine-tuning the application of firepower. ISR data generated by drones effectively "closed" the fire cycle (reconnaissance → decision → fire → assessment), albeit still under the general dominance of artillery and conventional air power. This transitional model is significant because it directly paved the way for the next phase, the shift in the role of drones from a fire support function towards an autonomous strike logic.[69]

[66] Düz 2020, 9–14.
[67] Düz 2020, 17–20.
[68] Hegedűs et al. 2023b.
[69] Rossiter – Cannon 2022.

## North-eastern Syria (Peace Spring): the discourse of "surgical strikes" and the target structure

Operation Peace Spring (2019) is much more explicitly about the political and operational duality of Turkish precision strike capabilities. Turkish political communication emphasized action against "terrorist targets" and the use of "surgically precise" strikes, serving simultaneously as a legitimizing narrative (operations are not directed against civilians) and a capability-signaling message (Türkiye is capable of modern, precision warfare).[70] This discourse, however, can only be properly understood if set alongside the actual structure of targets and the dynamics of the proxy battlefield.

The frequent reference to "surgical precision" in Turkish political and military communication should therefore be understood less as a purely technical description and more as a strategic narrative. This framing serves to legitimize military action domestically and internationally, while signaling technological competence and escalation control.

Operational reality, however, reveals a more complex targeting environment in which precision weapons coexist with intelligence uncertainty, proxy involvement, and dual-use infrastructure. The concept of "surgical strikes" thus functions as a discursive tool that partially masks, but does not eliminate, the inherent frictions of proxy warfare.

The targeting logic of Peace Spring can be captured along three main axes:

*(1) Command and communications points (C2/C3)*[71]

One of the greatest advantages of drones in the north-eastern Syrian environment was their ability to conduct prolonged target surveillance (pattern of life analysis) and to confirm targets. Against command posts, temporary headquarters, and communication nodes, drones – following appropriate target identification – were suitable for rapid strikes with limited destructive effects, particularly using micro-munitions.[72]

*(2) Mobile targets: vehicle columns, resupply, troop movement*

During Peace Spring, a significant share of targets was mobile in nature. Here, drones functioned not only as weapons platforms but as "sensor–fire control nodes," tracking, designating targets, and then either conducting their own strikes (with MAM munitions) or cueing artillery or air strikes. For this category of targets, reaction time and continuous surveillance constituted the decisive resources.[73]

*(3) Warehouses, weapons depots, and logistical hubs (and the dual-use dilemma)*

Storage facilities and depots often blended into civilian infrastructure (warehouses, industrial zones, facilities on the outskirts of settlements). Here, the tension between the "surgical" discourse and operational reality becomes acute, since even if a target is military in nature, its surroundings elevate the political and legal risks of a strike. Precision weapons may, in principle, reduce the likelihood of collateral damage, but they do not eliminate the risks stemming from misidentification, incomplete intelligence, or environmental factors.[74]

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70 Siccardi 2021.
71 Command, Control, and Communications.
72 Rosenblatt – Kilcullen 2020, 61–62.
73 Düz 2020, 20–21.
74 Rossiter – Cannon 2022.

At this point, the proxy dimension comes into play. In Peace Spring, Ankara relied heavily not only on regular forces but also on the SNA. The proxy-war "principal–agent" problem is highly relevant here: the political objectives of the sponsoring state (Türkiye) and the local goals of the proxy do not always coincide, and abuses or indiscipline on the ground can politically compromise even the most precise strike operations. Within this framework, drone warfare simultaneously represented (1) a technical advantage (continuous ISR–strike capability), (2) a control mechanism (top-down oversight of the battlefield), and (3) a communication tool (buttressing the narrative of a "precise/limited" operation).[75]

Overall, in the case of Peace Spring, the narrative of the "surgical" use of drones only partially captures the actual target structure. The reality is closer to a hybrid targeting system in which drones cover a broad spectrum – from command nodes through mobile targets to logistical infrastructure – all within a highly politicized, proxy-laden battlespace.

## Idlib and Operation Spring Shield: the drone campaign, PGMs, and the "industrialization" of the kill chain

What distinguishes Operation Spring Shield from earlier Turkish interventions is not merely the scale of drone usage, but also the routinized, repetitive, and accelerated functioning of the kill chain. In this sense, the campaign can be described as the "industrialization" of drone-enabled precision warfare, in which detection, engagement, and assessment were conducted in a continuous, near-real-time loop.

Operation Spring Shield represents the methodological apex of Turkish drone warfare in the sense that this was the point at which drones became the primary operational strike instrument. The campaign in Idlib had a dual objective: to rapidly degrade the Assad regime's offensive capabilities and to compel Moscow to accept a ceasefire arrangement while keeping Turkish escalation risks to a minimum.[76]

At the core of the campaign were the TB2 and ANKA-S, flown in large numbers of sorties – an approach described by several analyses as a "drone blitz".[77] Targeting in Idlib focused explicitly on the nodal points of the regime's conventional combat power:

- armored vehicles (tanks, armored personnel carriers);
- artillery batteries and rocket artillery elements;
- air defense systems (particularly Pantsir and Buk);
- logistical hubs and command elements.[78]

The essence of the operation was not sporadic drone employment, but the organized, accelerated, and repetitive functioning of the kill chain. In Idlib, the Turkish side effectively "industrialized" this cycle:

### *1) Reconnaissance (find–fix)*

Drones remained persistently over the front lines, continuously generating data on mobile targets. Syrian government armored and artillery units, due to the nature of their offensive

[75] Rosenblatt – Kilcullen 2020, 5–7.
[76] Rossiter – Cannon 2020.
[77] Kasapoğlu 2020.
[78] Düz 2020, 22–23.

operations, inherently exhibited a higher "observability profile" (they had to maneuver and fire), which favored ISR effectiveness.[79]

*2) Targeting and decision-making (track–target)*

During target identification and prioritization, drone video and sensor data could be rapidly exploited along the command chain. Different target types required different decision logics, as mobile armored units demanded faster reactions, while air defense targets required more cautious confirmation and often a "decoy–response" logic.[80]

*3) Engagement*

This phase highlighted the importance of the Turkish micro-munition ecosystem. MAM-L and MAM-C enabled drones to conduct a large number of strikes using their own onboard weapons, while tube artillery and rocket artillery could simultaneously engage targets designated by drones. This "drone + ground fire" combination became one of the operation's defining features.[81]

*4) Assessment*

Drones' immediate battle damage assessment (BDA) capability further shortened the cycle, as after a strike, the same platform could re-observe the target and, depending on the outcome, initiate follow-on strikes. As a result, the "closure" of the kill chain occurred in near real time, which proved particularly effective against artillery systems and mobile targets.[82]

A frequently cited factor behind the success of Spring Shield is the integration of electronic warfare and networked C2. The role of KORAL must be emphasized, as well as the fact that drone operations were not treated in isolation but within a true joint-force framework (EW, artillery, and supporting air components).[83] At the same time, one of the most frequently quoted lessons of Turkish drone warfare is precisely that MALE drones are inherently vulnerable on their own. The operation is truly effective only when drones operate within a system that at least partially suppresses, bypasses, or attenuates the air defense threat.[84]

## Effectiveness and military outcomes: success, adversary adaptation, and Turkish lessons learned

When assessing drone warfare in Syria, it is useful to distinguish clearly between tactical effects, operational outcomes, and the learning and adaptation responses of the adversary.

*Tactical level*

In Afrin, drones improved the accuracy of artillery fire, the quality of target identification, and the survivability of ground units. During Peace Spring, strikes against mobile targets and command nodes supported a higher operational tempo; while in Idlib, drones destroyed

79 Rossiter – Cannon 2020.
80 Düz 2020, 22–23.
81 Hehedűs et al. 2023c.
82 Düz 2020, 22–23.
83 Bakeer 2020, 2–4.
84 Bakeer 2020, 3–4; Düz 2020, 22–23.

a significant number of regime assets (armored vehicles, artillery, air defense systems) within a short period of time, producing an immediate tactical shock along the front.[85]

### *Operational level*

In Idlib, the campaign was not merely about "hitting many targets," but also about breaking the momentum of the Syrian offensive and improving Ankara's political–diplomatic bargaining position. After initial territorial losses, the Turkish operation halted further advances and steered the situation towards a ceasefire arrangement.[86] This marks the point at which drone warfare ceased to be merely a tactical innovation and became a strategic instrument. Military force, applied in a controlled manner and with relatively low own losses, generated pressure for negotiations.

### *Adversary adaptation*

Syrian actors responded to the drone threat through several well-known measures:

- Dispersion and concealment: distributed deployment of vehicles, short halts, rapid relocation, and reinforcement of "shoot-and-scoot" practices.
- Camouflage and deception: camouflage nets, shelters, false positions, and decoys.
- Electronic countermeasures: jamming of data links, navigation interference, and localized EW solutions.[87]

As a result, the effectiveness of drone warfare is not constant; it depends heavily on the density and sophistication of the air defense and electronic warfare environment.

Türkiye has channeled the Syrian experience in several directions:

- Platform and weapons development: the introduction of higher-payload UCAVs (e.g., Akıncı), further development of micro-munitions and guidance solutions, and the expansion of SATCOM connectivity.[88]
- Organizational and doctrinal integration: drones are no longer treated as a separate "branch," but as a capability integrated with artillery, EW, and command-and-control systems. This process can be described as a learning curve or "trial by fire," in which Syrian experience feeds back into Türkiye's overall operational thinking.[89]
- Refinement of proxy-warfare practices: drones also function as tools for supporting and exercising control over proxies such as the SNA, mitigating information gaps and principal–agent tensions.[90]

Taken together, the three case studies clearly illustrate how the role of Turkish drones evolved during the civil war. Afrin was primarily the terrain of ISR-based fire support and limited drone strikes; Peace Spring introduced the political–communicative framing of precision strikes and laid the foundations for cooperation with proxies; and Spring Shield delivered the accelerated, networked operation of the kill chain, in which drones emerged as the *de facto* backbone of the campaign.

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85 Van Veen 2021.
86 Van Veen 2021.
87 Rossiter – Cannon 2022.
88 Düz 2020, 23–26.
89 Rossiter – Cannon 2022.
90 Rosenblatt – Kilcullen 2020, 6–9.

# IMPLICATIONS AND LESSONS FOR TÜRKIYE AND THE INTERNATIONAL SYSTEM

Türkiye's precision strike capability – especially UCAVs and the associated ISR–C2–fire support architecture – represented a clear advance in Ankara's battlefield capabilities in Syria. At the same time, it became a defining element of Türkiye's force development, foreign-policy toolkit, and its ability to shape the *status quo* on the battlefield. Syrian operations provided a live "learning environment" in which Ankara simultaneously improved the speed of the kill chain, inter-service integration, and the management of expeditionary and proxy-type operations.

## Turkish force development and doctrinal evolution

One of the most important consequences of the Syrian experience is that drone warfare did not remain a standalone "capability island," but was gradually embedded in the Turkish Armed Forces' long-term strategy. The lessons are reflected not only in the growth of the number and range of drone types, but also in Ankara's increasing reliance on a network-centric operational logic with accelerated decision cycles. Also, shortening the kill chain became routine on the Syrian battlefield.

A key element of this process was the role expansion of drones. In practice, Turkish UCAVs functioned simultaneously as reconnaissance sensors, target-designation platforms, and strike weapon carriers, while being integrated with artillery, rocket artillery, and electronic warfare into a single system. This was particularly evident in Idlib. Although Operation Spring Shield was retaliatory in the short term, its strategic payoff was the stabilization of the boundaries between Turkish-held and regime-held territories – effectively fixing Ankara's "red lines" vis-à-vis the regime and Russia.

The spillover of doctrinal lessons to other theaters is likewise rooted in Syria. The literature frequently notes that without the Syrian experience, the rapid and confident emergence of the Turkish drone model in Libya and the South Caucasus would have been unlikely. The essence of the "Syrian model" is that Ankara was able to influence operational outcomes at relatively low risk to its own forces, using standoff methods based on drones and local partners/proxies. Early lessons from Syria were incorporated into later interventions driven partly by secondary interests (Libya, Nagorno-Karabakh), where drones delivered both tactical advantage and political prestige.

At the same time, the Syrian experience also highlighted a key limitation, as the success of MALE/UCAV platforms depends heavily on the nature of the air defense threat and the electromagnetic environment. Consequently, a hard doctrinal lesson for Türkiye was the need to deepen integration (EW, C2, artillery) and to move towards new drones with greater payloads and more advanced sensor suites (e.g., Akıncı).

## The international reputation of Turkish drone technology

The Syrian deployments – especially Idlib in 2020 – generated significant combat-proven marketing value for Turkish drones. On the international arms market, one of the most important currencies of credibility is whether a system has demonstrated its effectiveness in real combat conditions. In the case of the TB2 (and to a lesser extent the ANKA), Syria served as a "showcase battlefield," where drones not only conducted reconnaissance but

also delivered operationally meaningful precision strikes and, in some cases, proved capable of achieving results against air defense systems.

A tangible consequence of this reputational capital has been export success. According to Baykar's own statements, 36 countries have signed export agreements for the Bayraktar TB2, which in itself indicates that the TB2 has become a "global mass product" on the market for medium-capability, cost-effective armed drones.[91] This reputation was further strengthened by the fact that the TB2 became attractive not only to authoritarian or developing states. In 2021, Poland announced the purchase of TB2s as the first NATO member to do so, and by 2024, the delivery of the full package had been completed – an important milestone in terms of European legitimacy.[92] The striking performance of TB2 drones employed by Kyiv during the early phase of Russia's 2022 invasion of Ukraine likewise provided excellent publicity for Ankara.

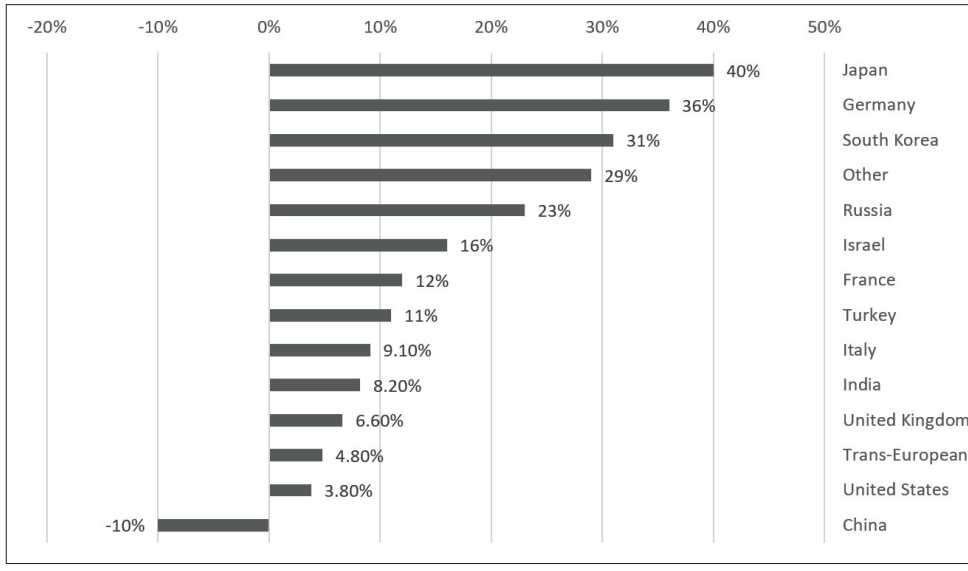



Figure 3 *Percentage change in the arms revenues of companies in the SIPRI Top 100 by country, 2023–2024*

Source: *Created by the author based on: Scarazatto et al. 2025, 2.*

Another reputational dimension of the Syrian "proof of concept" is that Türkiye has become a model middle power in the eyes of certain states. Drone-supported, networked precision strike operations offer a capability package that can partly substitute for expensive manned air forces and complex weapon systems that heavily depend on great powers. By the mid-2020s, this interest had also materialized in industrial cooperation. Baykar's European presence, for example, was strengthened by the acquisition of the Italian Piaggio Aerospace and by planned cooperation with Leonardo, suggesting that the Turkish drone

[91] Baykar 2025.
[92] Reuters 2021.

industry may gradually move from the role of a "peripheral supplier" towards that of a partner within certain European defense ecosystems.[93]

At the same time, this reputation is ambivalent. Drone exports and the Turkish "no-strings-attached" approach – highlighted in several analyses – do increase Ankara's influence, but they also generate controversies related to proliferation, conflict escalation, and arms export regulation.

## The Modification of the Dynamics of the Syrian Civil War

In Syria, Türkiye's precision strike capability altered the balance of power on several levels. At the tactical level, drones and precision-guided munitions reduced the exposure of Turkish and proxy forces. Continuous ISR coverage over the front line and rapid strike capabilities enabled Ankara to selectively degrade certain capabilities of Damascus or the Kurdish militias (armored vehicles, artillery, logistical hubs).

At the operational-political level, drones reshaped the concept of "local air superiority." During Operation Spring Shield, Türkiye did not establish sustained air superiority in the classical sense; instead, it achieved a form of "functional superiority" concentrated in specific time windows and target areas. This proved sufficient to halt the advance of Syrian government forces and influence the negotiation dynamics. One of the operation's key effects was precisely that it created a new balance between Turkish forces and Russian-backed regime units, effectively turning northern Idlib into a de facto Turkish protectorate for as long as the Turkish military presence remained.

At the systemic level, Turkish drone warfare contributed to the deepening of the Syrian conflict's "multi-layered" nature. While the theater remained multipolar – comprising states, proxies, and non-state armed groups –, the possession of precision drone capabilities provided Ankara with a tool that supported tighter control over proxies, rapid response, and the maintenance of the local *status quo*. For Türkiye, Syria thus generated a new foreign policy toolkit that later appeared in other regions as well.

All of this also feeds back into the international system. The proliferation of drones lowers the entry threshold for precision strike capabilities, potentially encouraging more middle powers to pursue harder power politics while accepting only limited risk. At the same time, Syrian – and subsequently especially Ukrainian – experience also indicates that drone superiority is not absolute. Adversary adaptation (camouflage, dispersion, electronic warfare, layered air defenses) gradually raises costs and reduces the "dramatic" effect. Accordingly, the durability of the Turkish model depends on Ankara's ability to sustain technological and organizational integration and adapt to the rapid spread of counter-drone capabilities.

# CONCLUSIONS

Türkiye's drone technology and the associated precision strike capability in Syria did not merely appear as a new weapons system; they fundamentally reshaped both the Turkish Armed Forces' way of warfare and the political room for maneuver of Türkiye's involvement in Syria. The TB2 and ANKA/ANKA-S platforms, the MAM-L/MAM-C micro-munitions, and the integration of ISR–C2–artillery–electronic warfare demonstrably shortened

[93] Reuters 2025.

the kill-chain cycle in practice. As a result, the role of drones in Syrian operations gradually shifted from an early, supporting ISR function towards that of a primary strike platform.

On the basis of the analysis presented in this study, the following conclusions can be stated with a high degree of confidence:

(1) Türkiye's precision strike capability in Syria is not an isolated technological innovation, but the outcome of a learning process closely linked to defense industrial autonomy ambitions and doctrinal adaptation within the armed forces.

(2) The impact of drones is most clearly captured in the TAF's ability to sustain and enforce their interests at lower political and personnel risks, particularly in environments where the establishment of sustained, costly classical air superiority was not feasible.

(3) Drones and precision strikes functioned as tools for modifying the local balance of power in the Syrian conflict. Within short time windows and in specific areas, Türkiye was able to create "functional superiority," influencing both front-line dynamics and negotiating positions.

It is important to emphasize that, like all analyses dealing with armed conflicts in the Middle East, this article also encounters clear limitations. A significant portion of reporting on the Syrian conflict carries an inherently propagandistic tone, as the various actors (state institutions, proxy groups, external sponsors) publish divergent casualty figures and success indicators, while visual evidence (footage, social media material) may be selective, decontextualized, or post-edited. Moreover, the case-study-based approach itself imposes constraints. Afrin, Peace Spring, and Idlib represent markedly different operational environments, meaning that conclusions drawn from them can only be cautiously generalized to the Syrian war as a whole or to other theaters of conflict.

At the same time, the findings presented here should not be interpreted as evidence of a universally applicable or permanently dominant model of warfare. The effectiveness of Turkish drone operations in Syria was contingent upon specific contextual factors, including fragmented air defenses, favorable geography, and the ability to combine UAVs with electronic warfare and artillery support.

Consequently, the "Turkish drone model" should be understood as a context-dependent solution rather than a blueprint that can be mechanically replicated in all conflict environments.

There are, however, two areas which, in my view, offer particularly promising avenues for further research. The first is an international comparison. Systematically comparing Turkish drone warfare with the approaches of the United States, Israel, Iran, or those observed in the Russo-Ukrainian war would help to distinguish more precisely what constitutes universal patterns of drone warfare (e.g., acceleration of the kill chain, ISR dominance) and what can be considered specifically Turkish characteristics (e.g., proxy integration, a "low-cost air force" logic, export-oriented industrial policy). The second is the deepening of quantitative analysis. Statistical examination of the relationships among strikes, target types, timing, operational outcomes, and adversary adaptation (using open-source event databases, geolocation, and time-series trends) could provide a stronger empirical foundation for conclusions regarding both effectiveness and limitations.

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