

Drones and the Future of Warfare

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The war between Russia and Ukraine has made it evident that the future of modern warfare lies with advancements. On October 29, a Russian fleet on the Black Sea near Sevastopol was attacked. The attack involved 16 drones, Nine aerial drones, and seven in the water. It is still unclear how much damage these drones brought to Russian vessels in the Black Sea, but the videos of the attacking drones showed that the vessels were unable to avoid being hit. In response to that, Russia has retaliated with scores of missiles and Iranian-built Shahed-136 drones aimed at electrical and water systems throughout Ukraine.¹ Both sides are committed to using the least of their aerial fleets and rely more on drones and UAVs for orchestrating attacks. The Russia-Ukraine war has changed the conventional wisdom on the use of drone technology in modern warfare.

For a long time, drones were deemed expensive, complicated, and unreliable to be deployed in an active warzone. Defense and aerospace industries spend a lot of resources and time to make their drones more reliable and accurate and even then, militaries would only deploy drones to carry out special tactical operations. However, a different approach was adopted by drone manufacturers in recent times. Instead of making expensive and complicated drones, some manufacturers started making cheaper and somewhat disposable drones. This approach came out as a game-changer for a thriving drone industry in countries like Turkey and Iran.

Turkish-made drones played a pivotal role in repelling Russia's initial wave of attack on Kyiv. Some experts believe that if drones were taken out of Ukraine's defense against Russia equation, Kyiv would have fallen during the first few days of the invasion. In one of his interviews, Ukrainian Vice Prime Minister Mykhailo Fedorov said, "we have been convinced once again the wars of the future will be about maximum drones and minimal humans."²

For years, military strategists have anticipated the arrival of the so-called drone swarm, a large cluster of small flying machines that will herald a new era of intelligent warfare. Thousands of robotic spreading out into an invisible formation, yet capable of instantly coalescing into

1. Andrew E. Kramer and Marc Santora, Russia Launches a Wave of Iranian-Made Drones at Kyiv, The New York Times, December 14, 2022. <https://www.nytimes.com/2022/12/14/world/europe/ukraine-russia-iranian-drones.html>

2. The Odessa Journal, Mykhailo Fedorov: The development of military tech is our priority for the coming years, Odessa Journal, September 01, 2022. <https://odessa-journal.com/mykhailo-fedorov-the-development-of-military-tech-is-our-priority-for-the-coming-years>

a swirling dark cloud, like a murmuration. Once such technology is within reach, it would change the course of warfare, defense, and security forever.³

Transformation of the Turkish drone industry

Turkey has made a tremendous stride in developing indigenous drones and UAVs paired with smart and technologically advanced munition systems. The Turkish military had been using its locally manufactured drones frequently in Syria during Operation Spring Field, however, It was not until February 2020, that Turkish drones gained a global spotlight. The operational success of Turkish drones in Syria was followed by substantial success in Libya and Nagorno-Karabakh, which provided the Turkish drone industry with a prestigious reputation in the global market that it had been striving to attain while the substantial success of Turkish drones in the Russia-Ukraine war has attested those reputations.

Based on this cemented reputation in 2022, Turkish drone manufacturers managed to capture the attention of the international market. In October 2022, Malaysian King Al-Sultan Abdullah visited Turkish drone manufacturing facilities in Ankara and announced a memorandum of understanding that Malaysia would not only buy Turkish-made drones but also integrate its defense industry with Turkey's. In July 2022, European multinational aerospace giant Airbus also awarded three contracts to a Turkish aerospace company. The contracts were related to Airbus A350F Barrier Wall, Airbus A320, and A220 Center Mid Lower Fuselage Panels. According to Turkish Aerospace, the company has been tasked to design, build and supply the Barrier Wall for Airbus' latest large widebody freighter, A350F. Under the contract, Turkish Aerospace will also supply Barrier Wall for A350F as the sole source throughout the entire program lifetime starting in 2024.⁴

Despite the proven capabilities in complex security environments, Turkish drones are not free from vulnerabilities, especially when operating in non-permissive airspace. To establish airspace for drone operations, the threats from the enemy's combat aircraft, surface-to-air missiles (SAM), and electronic warfare systems need immense improvements. Turkish-made drones only operate at an optimum operational capability if the military units have achieved dominance in the conflict zone. Some of the major Turkish drone manufacturers and their most successful models are enlisted below:

Ukraine's military received Bayraktar TB2 drones and more than 420 additional materiel items in March 2019. (Image Credit: Ukraine Ministry of Defense)



3. David Hambling, U.S. Army's New Drone Swarm May Be A Weapon Of Mass Destruction, Forbes, June 01, 2020. <https://www.forbes.com/sites/davidhambling/2020/06/01/why-new-us-armys-tank-killing-drone-swarm-may-be-a-weapon-of-mass-destruction/?sh=42993275ece8>

4. IRIA, Airbus awards three contracts to Turkish Aerospace, IRIA News, July 21, 2022. <https://www.ir-ia.com/news/airbus-awards-three-contracts-to-turkish-aerospace>

Baykar Technologies: Baykar is a privately owned Turkish defense company that specializes in attack and surveillance UAVs. The company has been in existence since 1984 and started as a mechanical parts-producing subcontractor for Turkish defense. In the early 2000s, Baykar started taking steps towards building unmanned aerial vehicles. In 2007, the Baykar Mini UAV was the first-ever drone produced entirely with domestic capital in Turkey. Later, Baykar moved on to produce high-precision attack and surveillance drones that are considered the best options in economical combat drones in Turkey and beyond. Some of its more famous models are:

Bayraktar TB2: Bayraktar TB2 drone is arguably one of the most iconic pieces of defense equipment from the Russia-Ukraine war. Bayraktar TB2 drone is a medium altitude long endurance UAV that can launch remote attacks on stationary and moving targets. The Turkish military is the largest operator of Bayraktar TB2 drones, however, it has been extensively used by the Ukrainian military to counter Russian invasion in the initial stages. Azerbaijan military and the Ethiopian National Defense Force are also among the top users of Bayraktar TB2 drones. Bayraktar TB2 can operate in altitudes of 18000 feet with 27 hours of flying endurance. It has an inverted V-tail body structure with a propeller configuration. The propeller is mounted at the tail. It can carry Turkish-made MAM missiles and BOZOK laser-guided bombs and launch them with precision. Baykar also makes export variants of these drones that can be integrated with foreign-made missile systems.

Bayraktar Akinci: Akinci is longer and wider than the Bayraktar TB2 and can perform strategic tasks. It has a 65-foot-wide wingspan with its unique twisted-wing structure and is equipped with fully automatic flight control and a triple-redundant autopilot system. The high-altitude long-endurance Unmanned Combat Aerial Vehicle is widely used by the Turkish Air Forces since August 2021, however, due to its higher cost, Akinci has not been acquired by international militaries.

Bayraktar Akinci Attack Drone is seen during Turkey's largest technology and aerospace event TEKNOFEST Istanbul, at Ataturk Airport, Istanbul, Turkey on September 17, 2019. (Image Credit: Muhammed Enes Yildirim/Anadolu Agency)



Turkish Aerospace: Turkish Aerospace (TAI) own one of the largest production plants in Turkey. Its Ankara-based production plant covers an area of 5 million square meters with an industrial

facility of 150,000 square meters under its roof. The company has a modern aircraft facility furnished with high-technology machinery and equipment that provide extensive manufacturing capabilities ranging from parts manufacturing to aircraft assembly, flight tests, and delivery. Apart from producing its UAVs, TAI has been involved in various aerospace projects with Airbus, Boeing, Lockheed Martin, Northrop Grumman, Sikorsky, and numerous other defense giants from around the world.

Anka: Anka is TAI's flagship drone. Envisioned in the early 2000s for aerial surveillance and reconnaissance missions, Anka has evolved into a combat, surveillance, precise attack, and satellite communication drone. The basic version, Anka-A, was classified as a medium-altitude long-endurance unmanned aerial vehicle for reconnaissance missions. Higher-tier versions of this drone include Anka-B, which is a weaponized platform equipped with electro-optical/infrared sensors. Anka-S is equipped with a SATCOM antenna and a national flight control computer which gives it more precision control.⁵

Iranian drone industry

In May 2022, an Iranian state-owned media outlet aired video footage from an underground drone base in Zagros mountains. The video showed 100s of combat drones including Iran's most advanced and newly built Ababil-5 drone which is equipped with a Qaem-9 missile system. Ababil-5 is the Iranian version of the U.S. Hellfire air-to-surface attack drone.⁶

A report published by Conflict Armament Research (CAR) suggests that Iranian drones are not only copying designs from western drones but they are also using western-built semiconductors despite economic sanctions. The remains of three models of advanced Iranian drones, the Shahed-131, and the Shahed-136, were analyzed by CAR. The drones have been designed to crash into their target and explode on impact. Another model, the Mohajer-6 armed surveillance drone, was also analyzed. The analysis showed that all these models used western-



built semiconductors. It is still unclear how is Iran sourcing these semiconductors despite severe economic sanctions.⁷

The Iranian drone industry is largely made up of government-owned initiatives that are producing cheap combat drones to be used by its military. However, in the wake of the Russia-Ukraine war, the heavily sanctioned Iranian defense industry made unofficial deals with Russian counterparts to supply Russian forces with many cheap drones to be used against Ukrainian targets.⁸

6. IRIA, Iran shows off underground drone base without revealing its location, IRIA News, May 31, 2022. <https://www.ir-ia.com/news/iran-shows-off-underground-drone-base-without-revealing-its-location>

7. John Ismay, Iranian Weapons Built With Western Semiconductors Despite Sanctions, The New York Times, November 22, 2022. <https://www.nytimes.com/2022/11/22/us/drones-russia-iran.html>




8. Joby Warrick, Souad Mekhennet, and Ellen Nakashima, Iran will help Russia build drones for Ukraine war, Western officials say, The Washington Post, November 19, 2022. <https://www.washingtonpost.com/national-security/2022/11/19/russia-iran-drones-secret-deal/>

Russia struck Ukraine's key civilian infrastructure on October 10, destroying power plants and substations, plunging half the country into darkness just before winter arrives. Despite official denials from both sides, it is evident that Russia has imported hundreds of Iranian Shahed-136 kamikaze drones to deadly effect and over 1,000 more are on their way from Tehran, according to reports. In return for its drones, Iran plans to acquire Russian-made Su-35 fighter jets. There is very limited information about Iran's drone production facilities and capabilities. Some of the most profoundly used Iranian drones by Russia are highlighted below.

Shahed-129: Shahed 129 is one of the largest and most advanced attack drones from Iran's Shahed series. It can carry up to eight bombs. It can also be paired with Iranian-made Sadid missiles. Shahed 129 is a single-engine medium-altitude and long-endurance drone. It is capable of flying for almost 24 hours. The UAV has been used for airstrikes in the Syrian Civil War and for border patrol on Iran's eastern border. The Shahed 129 is the backbone of Iran's high-end UAV fleet.

Shahed 131 and Shahed 136: Three-and-a-half-meter-long Shahed 131 and Shahed 136 drones are designed to act as kamikaze attack drones. The aircraft has a cropped delta-wing shape, with a central fuselage blending into the wings and stabilizing rudders at the tips. The drones can carry warheads in their nose section estimated to weigh 30–50 kilograms. In October 2022, Russia used suicide drones bearing the name Geran-2 against Ukraine. These Geran-2 drones are considered by Ukraine and its Western allies to be redesignated Iranian-made Shahed-136 drones, however, both Iran and Russia deny the claims about such cooperation.

Mohajer-6: Mohajer was Iran's first drone to enter series production in the 1980s. First unveiled in 2017, Mohajer-6 officially entered serial production in February 2018 and was designed to carry out both reconnaissance and attack operations for the Iranian military. Mohajer-6 "is an Intelligence, Surveillance, Target Acquisition, and Reconnaissance (ISTAR) UAV capable of carrying a multispectral surveillance payload and/or up to two precision-guided munitions" according to the U.S. Army's Training and Doctrine Command (TRADOC) report.

Mohajer-6 Qods Aviation Industry	Shahed-161 Shahed Aviation Industry	Shahed-129 Shahed Aviation Industry
		
Dimensions Length: 5.6 meters Wingspan: 10 meters Gross weight: 600 kilograms Payload Capacity: 100 kilograms	Dimensions Length: 2.7 meters Wingspan: 7.3 meters Gross weight: 500 kilograms Payload Capacity: 100 kilograms	Dimensions Length: 8 meters Wingspan: 16 meters Gross weight: Unknown Payload Capacity: 400 kilograms
Performance Maximum speed: 200 km/h Range: 1,800 kilometers Endurance: 12 hours Service ceiling: 18,000 feet	Performance Maximum speed: 350 km/h Range: 1,500 kilometers Endurance: 4.5 hours Service ceiling: 25,000 feet	Performance Maximum speed: 150 km/h Range: 1,700 kilometers Endurance: 24 hours Service ceiling: 7,300 feet
Armament and Sensors 4 Qaem TV/IR-guided missiles Laser Range Finder Multispectral IR Sensor	Armament and Sensors 2 Sadid 1 Missiles <small>* Design of Shahed-161 drone is largely based on Lockheed Martin's RQ-170</small>	Armament and Sensors 4 Sadid-345 PGM Oghab-6 optical IR sensor Laser range finder



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