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The Strategic Power of Unmanned Systems in Reshaping the Global Order

In peacetime, no military can predict with complete accuracy the doctrine that future wars will require. What matters is the ability to recognize mistakes and adapt as quickly as possible once war begins.

Michael Howard.

INTRODUCTION

The military and civilian spheres are undergoing one of the most profound paradigm shifts since the Industrial Revolution transferred physical labor to machines. As General David H. Petraeus and many other experts have noted (Petraeus & Roberts, 2023, pp. 1–3), the integration of unmanned systems with artificial intelligence (AI) and data-driven decision-making is accelerating this transformation. Unmanned systems have evolved far beyond simple “remotely controlled devices” into a vast “ecosystem” that is fundamentally reshaping military doctrines, strategic visions, and states’ ability to project power. Their potential to drive significant advances in civilian applications is also increasingly apparent.

The scale of this transformation is evident in the striking figures emerging from the battlefield. The Ukraine-Russia front has become something of a laboratory in this regard. According to recent research (Anokhin, 2026), Ukraine uses approximately 300 to 400 armed unmanned aerial vehicles (UAVs) a day along this front, while Russia uses between 120 and 200. Russia reportedly launched 8,161 Shahed-type UAVs, including decoys, in May 2026 alone.

¹ <https://www.tepav.org.tr/en/ekibimiz/s/1046>

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Ukraine's reported production capacity also points to the growing scale of drone warfare (National Security and Defense Council of Ukraine, 2026). Although reliable data on Russian output are difficult to obtain, Ukraine's annual first-person view (FPV) drone production capacity is reported to exceed eight million units. Research suggests that UAVs had become the leading cause of losses along the Ukraine-Russia front line by 2025 (International Institute for Strategic Studies, 2026). Some assessments also indicate that nearly 80 percent of personnel casualties are linked to UAVs.

Striking figures also emerge beyond the battlefield. According to recent data from the Federal Aviation Administration (FAA), the United States (U.S.) has 837,513 registered drones and 481,760 certified remote pilots (Federal Aviation Administration, n.d.). The registered civilian and commercial drone fleet in the U.S. alone is therefore many times larger than the entire fleet of crewed aircraft in many countries. In agriculture, approximately 400,000 drones were in use across 100 countries by the end of 2024 (DJI Agriculture, 2025). These systems are estimated to have saved around 222 million metric tons of water. Rwanda offers an even more striking example in health care (Rubuga et al., 2025). Drone-based logistics systems are reported to have reduced emergency response times by 75 percent and blood product wastage by 95 percent. In commercial logistics, a single company has completed more than one million drone deliveries (Wing, 2026), illustrating how UAVs are expanding beyond mapping and observation into the transport of goods.

Taken together, these examples show that the convergence of UAVs, unmanned surface and underwater platforms, ground robots, autonomous logistics systems, and AI-driven decision-making networks represents more than a technological innovation. It forms a technological ecosystem with the potential to reshape states' military strategies, the way companies do business, and everyday life.

1. UNMANNED SYSTEMS AND DRONES IN THE LITERATURE

One of the main challenges in discussing unmanned systems is conceptual confusion. The terms "unmanned," "remotely controlled," "autonomous," "drone," "UAV," and "robotic system" are not interchangeable. In its broadest sense, an "unmanned system" is any platform that carries out an assigned task without a person on board (Nichols et al., 2020, p. 5). Such a system may be controlled by a human operator, including remotely, or perform certain tasks automatically. Being unmanned, however, does not make a system autonomous. Autonomous unmanned systems are built by integrating multiple subsystems (Austin, 2010, p. 1).

UAVs, including armed UAVs, are aircraft without an onboard pilot that can be operated remotely or automatically (U.S. Department of Defense, 2013, p. 15). They may operate autonomously, semi-autonomously, or under remote control. For example, a rotary-wing UAV flown by a human using FPV⁴ goggles and a live video feed is not fully autonomous. A system that can fly to preprogrammed coordinates but cannot select a target is semi-autonomous. A fully autonomous system can perceive its surroundings, assess potential targets, change its flight path, and choose its own actions within predefined limits.

Although the term "drone" is widely used in the literature, it has no single, universally accepted technical definition. Clarke (2014) defines a drone as an aircraft capable of controlled flight and of performing a specific function without a human pilot on board. The defining feature is the

⁴First Person View (FPV) drones are unmanned aerial vehicles equipped with first-person view technology. An onboard camera transmits live video to the pilot through dedicated FPV goggles or a monitor, creating the experience of flying from inside the drone. Compared with other drones, they allow for faster, more agile flight.

absence of an onboard pilot. The system does not have to be fully autonomous. A drone may therefore be operated remotely by a human or carry out certain tasks automatically or autonomously.

Hassanalıan and Abdelkefi (2017) approach the concept from an engineering and robotics perspective. They describe drones as robots that can fly under remote control or autonomously without a human operator on board. These vehicles can carry lethal or nonlethal payloads. The term “drone” alone therefore does not indicate whether a vehicle is armed, autonomous, or assigned to a specific military mission. Armed drones constitute only one subset of this broad category, which also includes vehicles used for reconnaissance, surveillance, mapping, logistics, and civilian purposes.

A terminology study published in *Drone Systems and Applications* proposes using “drone” as an umbrella term encompassing all robotic vehicles. The study classifies drones according to whether they operate in the air, on land, on the water’s surface, underwater, or in space (Chabot et al., 2022).

Colomina and Molina (2014) note that terms such as UAV, unmanned aircraft system (UAS), and drone are used alongside one another in the academic and technical literature. UAV refers primarily to the aircraft itself, whereas UAS encompasses the aircraft, its ground control station, and the command-and-control data link between them. Turkish academic literature also notes that “drone,” “İHA” (insansız hava aracı, or UAV), and “İHAS” (insansız hava aracı sistemi, or UAS) are sometimes used as near synonyms or interchangeably, despite differences in their technical scope.

“Drone” and “autonomous system” are not synonymous either. Autonomy is a separate attribute that describes how a drone is controlled and the extent to which the system makes its own decisions. Nor are all drones armed. Armed UAVs constitute a specific category of drone systems capable of carrying and using weapons (Hassanalıan & Abdelkefi, 2017).

In this study, “drone” is used as an umbrella term for robotic vehicles that carry no human crew, operate on land, in the air, on the water’s surface, or underwater, and perform missions under remote command or control, semi-autonomously, or autonomously.

The literature also offers no single, universally accepted method for classifying drones. Common criteria include weight, size, range, altitude, aerodynamic configuration, and mission. Size and weight categories include nano, micro, mini, small, tactical, and large systems. Range categories distinguish close-, short-, medium-, and long-range systems, while operating altitude provides the basis for low-, medium-, and high-altitude categories. Aerodynamic configurations include fixed-wing aircraft capable of horizontal takeoff and landing, vertical takeoff and landing systems, helicopters and multirotors, hybrid designs such as tiltrotors and tiltwings, and unconventional designs. Classification by mission encompasses systems developed for reconnaissance and surveillance, tactical and strategic missions, strike and combat operations, logistics, and various civilian tasks. Drones are therefore classified not only by their physical size but also by their range, weight, and intended mission (Hassanalıan & Abdelkefi, 2017, pp. 99–101).

The meaning of “drone” and the classification of drones therefore remain complex and contested. The term can refer to a rotary-wing UAV weighing only a few hundred grams, a strategic high-altitude reconnaissance platform capable of remaining airborne for hours, an armed UAV carrying munitions, or a one-way attack vessel that destroys itself on impact with a target.

2. THE ECOSYSTEMS BUILT AROUND UNMANNED SYSTEMS

Assessing the value of an unmanned system solely in terms of the platform itself can be misleading. Modern drones owe their effectiveness to an ecosystem of electro-optical or infrared sensors, satellite or other data links, ground control stations, and image-processing algorithms.

Even without carrying munitions, a reconnaissance drone can be a critical link in a strike mission by transmitting data in real time (U.S. Department of Defense, 2013, pp. 8, 126–127). It can detect a target, calculate its coordinates, transmit them to a fire support asset, and assess the effects of the strike. In military operations, UAVs can now perform multiple roles at once, serving as forward observers, forward air controllers, and fire support assets. Similarly, an unarmed underwater vehicle can map the locations of naval mines, while an unmanned surface vehicle can reconnoiter enemy ports. A UAV can simultaneously serve as a communications relay, an electronic warfare platform, and a target acquisition sensor. In this sense, drones can be seen as having evolved into ecosystems capable of performing a range of missions effectively.

Drone swarms, which can operate collectively, are among the clearest examples of these ecosystems. At first glance, the term may suggest little more than the simultaneous use of large numbers of UAVs. However, it refers to a multilayered, autonomous ecosystem in which UAVs communicate and coordinate their actions to carry out a shared mission. Drones can allocate tasks, plan their own flight paths, and coordinate movements using data on neighboring vehicles' positions and status. These capabilities reduce the need for continuous intervention by a central operator. Because the loss or failure of a single vehicle does not necessarily disable the entire system, drone swarms offer advantages in mission continuity, fault tolerance, flexibility, and scalability. These characteristics make them well suited to wide-area surveillance, tracking multiple targets, search and rescue, reconnaissance, infrastructure inspection, environmental monitoring, mapping, and cargo transportation (Chung et al., 2018, pp. 837–839).

3. A BRIEF HISTORY OF UNMANNED SYSTEMS

The “Predator”⁵, “Reaper”⁶ and today’s quadcopters feature prominently in the history of unmanned systems (Vilmer, 2026, p. 233). Yet the idea of removing human operators from platforms that expose them to danger is much older. The Siege of Venice in 1849⁷ offers an early example of the thinking behind modern unmanned aircraft systems. During the siege, Austrian forces attempted to send unmanned balloons carrying explosives over Venice. Because the balloons had limited directional control, whether they qualify as UAVs or autonomous systems in the modern sense remains open to debate. Nevertheless, they were among the earliest attempts to deliver explosives to a target area using an unmanned aerial platform.

⁵ The MQ-1 Predator is a UAV used primarily by the United States Air Force (USAF) and the Central Intelligence Agency (CIA). Originally intended solely for surveillance and forward reconnaissance in the 1990s, it was later fitted with new cameras and missiles. Since 1995, it has seen combat in Afghanistan, Pakistan, Bosnia and Herzegovina, Serbia, Iraq, and Yemen.

⁶ The MQ-9 Reaper is a medium-altitude, long-range UAV developed primarily for the USAF. It can fly under remote control or autonomously.

⁷ The siege took place during the First Italian War of Independence, when the Austrian Empire besieged Venice by land and sea after the city declared independence, forcing its surrender in August 1849.

The real technological breakthrough, however, came during World War I with advances in gyroscopes⁸, radio control, and autopilot technology (Naval History & Heritage Command, n.d.). The war's "aerial torpedo" projects were among the earliest attempts to deliver explosives to a predetermined target without a pilot. These projects are regarded as technological precursors to later unmanned aircraft systems and, in particular, cruise missiles.

During World War II, the technology developed along two distinct paths (Williams, 2025). The first involved radio-controlled target aircraft used to train anti-aircraft units. The second involved V-1 missiles, expendable weapons designed to deliver explosives to a target. Technically, the German V-1 was closer to a cruise missile than a modern UAV. Nevertheless, it marked an important step in the development of expendable unmanned aerial systems that followed a predetermined route. Some of today's one-way attack systems described as "drones" are also functionally similar to cruise missiles.

During the Cold War, reconnaissance and intelligence gathering became the main missions of unmanned aerial platforms (Beene, 2002, p. 46). The downing of a crewed reconnaissance aircraft could result in personnel being killed or captured and could also have major political consequences. Deploying unmanned reconnaissance systems has therefore become an important way to reduce the political and human costs of intelligence gathering, particularly in high-risk airspace.

According to a study of the Cold War, Eastern Bloc air defenses shot down at least seven U.S. reconnaissance aircraft between 1950 and 1960, killing 76 American personnel (Lin-Greenberg, 2025, pp. 69–70). The loss of crewed reconnaissance aircraft also risked triggering diplomatic crises. These experiences prompted U.S. decision-makers to turn to unmanned alternatives for high-risk reconnaissance missions.

The Vietnam War was one of the first conflicts to see the large-scale use of UAVs for reconnaissance and intelligence gathering (Center for Strategic and Budgetary Assessments, 2013). The U.S. Air Force deployed UAVs over North Vietnam for photographic reconnaissance, electronic intelligence collection, and the detection of air defense systems.

In the 1973 Arab-Israeli War, Israel used UAVs as decoys to deceive enemy air defenses (Borg, 2020). On the Sinai front in particular, these aircraft were used to divert enemy air defenses from actual combat aircraft and draw anti-aircraft fire. During the same war, Israel sent a group of UAVs toward the Golan Heights, leading Syrian air defenses to believe that a real airstrike was underway (Darack, 2011). Syrian forces fired dozens of surface-to-air missiles at these decoys, helping to deplete their air defense missile stocks.

Israel's Operation Mole Cricket 19 in the Bekaa Valley in 1982 demonstrated the value of UAVs as part of a broader ecosystem integrating reconnaissance, electronic warfare, and strike capabilities, rather than as stand-alone platforms (Rodriguez, 2018, pp. 56–59). Israel used remotely piloted vehicles to lure Syrian air defenses into activating their radars, collect radar and targeting data, provide real-time intelligence, and assess battle damage after strikes. Unmanned platforms thus became critical components of an integrated operation alongside electronic warfare assets and crewed strike aircraft.

Developed in the 1990s, the Predator marked another turning point in the evolution of unmanned aircraft systems (Office of the Secretary of Defense, 2002, p. 6). The platform first

⁸A gyroscope is a spinning wheel or disk whose axis of rotation is free to assume any orientation. The conservation of angular momentum allows the axis to maintain its orientation even when its support is tilted or rotated. Gyroscopes can therefore be used to measure or maintain orientation.

flew in 1994. Its long endurance and satellite data link enabled it to transmit the imagery it collected to command centers in real time.

4. RETHINKING GEOPOLITICS AND GEOGRAPHY IN THE DRONE AGE

The combination of drones' range and endurance, satellite communications, electro-optical and infrared sensors, and precision-guided munitions is rapidly transforming the traditional military significance of geography. It would be inaccurate to suggest that drones have made geopolitical conditions or geography irrelevant. They have, however, weakened the natural protection afforded by distance, climate, rugged terrain, the cycle of day and night, and a position behind the front lines. In the modern operational environment, protecting critical facilities and infrastructure, sustaining air defenses, and managing the balance between the costs of attack and defense are therefore gaining importance alongside geographic depth (Rogers & Hutto, 2026).

Traditional military thinking regarded industrial facilities, air bases, logistics hubs, and command facilities hundreds of kilometers from the front as relatively secure. Long-range UAVs are increasingly challenging this assumption. One Ukrainian long-range UAV unit, for example, operates systems capable of reaching up to 2,000 kilometers into enemy territory (Smilianets & Karazy, 2025). Another notable example occurred in April 2024, when a Ukrainian UAV reached an oil refinery in Tatarstan, approximately 1,300 kilometers from the front line (Faulconbridge & Soldatkin, 2024). Such examples show that physical distance from the front does not automatically keep critical facilities safe.

Drone technology has not entirely eliminated the defensive advantage of geographic depth, but it has made that advantage insufficient on its own. Modern UAVs combine long range and endurance with electro-optical and infrared systems that reduce the protection afforded by darkness and poor visibility. This allows them to detect and track targets by day and night and, when necessary, destroy them with precision-guided munitions (U.S. Air Force, n.d.).

The assumption that "the farther from the front, the safer the location" is therefore becoming less reliable in modern warfare. Geographic depth still matters, but it cannot provide adequate protection on its own unless reinforced by air defense, electronic warfare, camouflage, hardened shelters, and system redundancy. The expanding UAV threat has heightened the importance of oil and gas facilities, energy infrastructure, airports, ports, ammunition depots, communications hubs, and command-and-control facilities. These facilities share an economic or military significance far greater than their physical size would suggest. For example, the 2019 attack on Saudi oil facilities temporarily halted production of 5.7 million barrels per day (Saudi Aramco, 2019). This represented approximately half of Saudi Arabia's production at the time and about 5 percent of global oil supply. A disruption of this magnitude had damaging strategic consequences for the global order.

These examples show that defense in the drone age involves more than protecting the front line. The continuous protection of strategic infrastructure has become a core element of national security. One of the most significant challenges posed by UAVs is the cost asymmetry between attack and defense. A small, mass-produced UAV may cost thousands or tens of thousands of US dollars, whereas the conventional air defense munition used to intercept it can cost hundreds of thousands or even millions.

One striking example from the Red Sea involved the use of a Standard Missile-2 (SM-2) air defense missile costing approximately US\$2 million against a Houthi UAV estimated to cost around US\$2,000 (Rumbaugh, 2024). Based on munition prices alone, this amounts to an

attack-to-defense cost ratio of approximately 1:1,000. Similarly, a US\$500 commercial drone can destroy a tank worth US\$1 million, or a US\$20,000 maritime drone can destroy a vessel worth US\$20 million.

Yet this ratio can be misleading in isolation. The warship, airport, refinery, or command center being defended may itself be worth billions of dollars, and the strategic cost of losing it may far exceed the price of the interceptor. The underlying problem is that the large-scale use of low-cost UAVs forces defenders to keep costly sensors and personnel at constant readiness and continually replenish their stocks of interceptors (Rumbaugh, 2024).

The drone age therefore calls for a reassessment of geography's role in security rather than a dismissal of its importance. As the traditional protection afforded by distance and strategic depth weakens, protecting critical infrastructure, sustaining defenses against low-cost aerial threats, and managing the balance between the costs of attack and defense become increasingly important.

5. THE FAKHRIZADEH ASSASSINATION AND THE FADING BOUNDARIES BETWEEN HUMAN AND MACHINE

Mohsen Fakhrizadeh was a physicist and academic who served as a brigadier general in the Islamic Revolutionary Guard Corps and was described as the architect of Iran's nuclear program. His killing near Tehran on November 27, 2020, became emblematic of debates about unmanned and robotic systems. Iranian officials stated that the attack had been carried out with a remotely controlled machine gun mounted on a pickup truck and that the system used a satellite link and facial recognition technology (Al Jazeera, 2020).

The key distinction is between a remotely controlled robotic weapon and an autonomous weapon that selects its own targets. If a human selects the target and the weapon simply aims and fires, a substantial part of the decision-making loop remains under human control. The Fakhrizadeh operation is also discussed in terms of the "balance between risk and capability," rather than solely as a technical example of remote weapons use (Lin-Greenberg, 2025, pp. 96–97). A specially designed, remotely controlled system reduced the risks associated with deploying personnel on the ground while preserving the ability to reach the target. This made it possible to carry out high-risk operations that would have been more difficult using alternatives requiring an operator at the scene.

The significance of the Fakhrizadeh case lies in showing that future assassination and precision-strike capabilities need not be confined to unmanned aircraft. The same logic can extend to stationary robotic weapons platforms, ground vehicles, unmanned boats, and other combinations of sensors and networks. The incident also had a psychological warfare dimension, conveying to senior Iranian officials that they were not safe and could be targeted at any time.

6. THE DEMOCRATIZATION OF TECHNOLOGY AS DRONE USE SPREADS FROM STATES TO NONSTATE ACTORS

One of the most significant strategic consequences of drone technology is that nonstate actors can now acquire capabilities once reserved for major powers. Cronin (2020, pp. 202–203) argues that the convergence of new technologies is weakening states' traditional monopoly over violence and weapons. In her analysis, the combination of drones, robotic systems, smartphones, three-dimensional (3D) printers, and autonomy technologies gives individuals and nonstate groups unprecedented global and operational "reach."

The cost and logistical demands of strategic military UAVs put them beyond the means of nonstate actors. Small commercial UAVs, however, can readily be weaponized using cameras, data links, and basic engineering skills (Grossman, 2018, pp. 97–108). The effective use of UAVs by the Islamic State of Iraq and al-Sham (ISIS)⁹ was an early and visible example of this shift. The group's own documents show that it had an established drone unit by 2015. They also include plans to use UAVs for attacks (Rassler et al., 2017).

Türkiye has faced a similar challenge. While the country has used UAVs extensively for intelligence, surveillance, reconnaissance, and counterterrorism operations against the terrorist organization Kurdistan Workers' Party (PKK), the PKK's access to low-cost commercial UAV technology has also substantially altered the security paradigm in Türkiye (Bural, 2021). Open sources have documented numerous examples of the PKK using commercial UAVs, particularly for reconnaissance and surveillance.

UAVs, including armed UAVs, are becoming indispensable components of sophisticated military operations. The attacks on Israel on October 7, 2023, for example, showed that commercial UAVs could be used both to strike targets directly and to degrade Israel's surveillance and intelligence capabilities (Byman et al., 2023). In the opening phase of the attack, Hamas used commercial UAVs to drop explosives on observation towers, sensors, and remotely operated weapons systems along the Israeli border, disabling surveillance and communications infrastructure in some areas. With low-cost UAVs, Hamas inflicted serious damage on a far more expensive and sophisticated defensive architecture.

The Houthis'¹⁰ use of UAVs offers another striking example of how unmanned systems in the hands of nonstate actors can have regional and even global effects (Nevola & d'Hauthuille, 2024). Research indicates that UAVs were used in more than 40 percent of Houthi attacks on international shipping between October 2023 and June 2024. On September 16, 2026, Saudi Arabia announced that it had shot down a Houthi UAV south of Mecca (Reuters, 2026). The incident illustrates how the areas requiring protection against unmanned systems are expanding geographically. These now extend beyond military bases to include holy sites, energy infrastructure, airports, and civilian transport routes. It also demonstrates the Houthis' ability to sustain offensive and defensive operations that require a continuous expenditure of resources (Nevola & d'Hauthuille, 2024). The Houthis possess unmanned maritime vehicles as well as UAVs. An attack on a cargo ship in June 2024 brought the threat these systems pose to maritime trade into sharp focus.

7. CONVENTIONAL WARFARE AND DRONES

Over the past decade, a series of developments has brought UAV technology into conventional warfare. The Second Karabakh War¹¹ offers a particularly instructive example. Azerbaijan used Turkish-made armed UAVs and Israeli-made reconnaissance UAV systems during the conflict (Stockholm International Peace Research Institute [SIPRI], 2021). The extensive use of unmanned systems demonstrated that they had become an integral part of conventional warfare.

This became even clearer in the Russo-Ukrainian War. The war that began in 2022 marked a major turning point in the history of UAV use (Williams, 2026, pp. 206–207). UAVs became

⁹ The Islamic State of Iraq and al-Sham (ISIS), which has used the name Islamic State since 2014.

¹⁰ The Houthi movement, formally known as Ansar Allah, is a political and military organization that emerged in Yemen in the 1990s. Its members are predominantly Zaydi Shia, and its leadership is drawn largely from the Houthi clan.

¹¹ The war fought between Azerbaijan and Armenia from September 27 to November 10, 2020.

tactical tools available to infantry units, alongside their use as strategic systems by special forces and air forces. This new operational concept integrates reconnaissance quadcopters, FPV attack drones, one-way attack and long-range platforms, electronic warfare systems, and unmanned maritime vehicles within a single combat environment. In Ukraine, UAVs have become ubiquitous along the front, with their role extending beyond that of standard equipment for conventional infantry, artillery, and armored units.

Unmanned systems are changing modern battlefield tactics, from tank operations and positional warfare to infantry concealment, artillery target acquisition, and logistics. Small, inexpensive FPV drones are being used to strike targets that would otherwise require far more costly munitions to destroy.

As electronic warfare systems have become more widespread, new solutions have emerged to prevent conventional FPV drones controlled by radio signals from being brought down. One of the most notable developments is the use of drones controlled through fiber-optic cables (Center for Strategic and International Studies, 2025). These systems transmit commands and video through a thin fiber-optic cable that unwinds from a spool carried onboard, replacing the wireless link. This makes them largely immune to radio-frequency jamming and allows them to maintain high-quality video transmission even in environments with intense electronic warfare activity. Both sides in the Russo-Ukrainian War are reportedly making increasing use of these systems (Royal United Services Institute, 2026). Early versions had a range of approximately 10 kilometers, while some newer systems carry fiber-optic cables up to 60 kilometers long. Countermeasures, including electronic warfare systems, signal jammers, cage armor, active protection systems, and counter-UAV weapons, are also evolving rapidly.

Although UAVs have become a defining feature of the war in Ukraine, unmanned maritime systems have also gained importance (Wertheim, 2025). Despite lacking a large conventional navy, Ukraine has used unmanned maritime vehicles to conduct successful attacks on Russian vessels, ports, and critical infrastructure in the Black Sea. Their use against Russian ships since 2023 has changed the nature of naval operations in the region.

Building conventional naval power requires substantial investment in ships, shipyards, and crew training. Unmanned underwater vehicles, by contrast, can pose an asymmetric threat to high-value targets at a fraction of the cost (Nichols et al., 2020, pp. 130–164). These vehicles serve a wide range of purposes, including mine countermeasures, intelligence, surveillance and reconnaissance, anti-submarine warfare, oceanography, communications, and cargo transport.

The U.S.–Israel–Iran war is the latest example of UAV technology becoming a strategic asset. Drones, however, are only one of the factors reshaping the conduct of this war. Ballistic and cruise missiles, along with air power, have also been used extensively. Missile and UAV attacks by Iranian-backed forces against vital infrastructure in the Gulf have exposed vulnerabilities in existing air defense and electronic warfare systems. UAVs can strike targets ranging from ports and data centers to electricity grids and front lines (Reuters, 2026, March 16). Most significantly, the proliferation of unmanned systems has erased the distinction between areas of civilian economic activity and war zones.

8. ARE UNMANNED SYSTEMS ONLY WEAPONS?

The public's tendency to associate drones with images of warfare can overshadow their other uses. Yet one of the main reasons for the spread of unmanned systems is their ability to provide

data more quickly, flexibly, and at lower cost than crewed platforms in applications of public interest. Systems used for civilian purposes have also contributed to intelligence production.

UAVs are used across a wide range of civilian fields, including mapping, agriculture, mining, construction, disaster response, meteorology, and archaeology (Shahmoradi et al., 2020, pp. 1–2; Shakhathreh et al., 2019, pp. 48587–48590). In agriculture, multispectral cameras allow users to monitor crop health and identify water stress, pest infestations, and fertilizer needs. UAVs equipped with spraying systems can support precision agriculture by treating only the areas that require attention, saving time and resources.

In mapping, UAV photogrammetry enables the production of high-resolution orthophotos¹² and three-dimensional terrain models (Colomina & Molina, 2014, pp. 90–91). UAV-based systems can provide highly accurate data at low cost for forestry, urban planning, and disaster management. In disaster response, drones sent into areas that are dangerous or time-consuming for people to reach can assess earthquake damage, map the extent of flooding, and locate missing persons (Restas, 2015, pp. 316–321). Autonomous mine detection is another important application that reduces human exposure to danger (Yoo et al., 2020, pp. 2035–2039). UAVs carrying magnetometers can help identify landmine locations safely.

Logistics is another area in which autonomous systems are bringing about a significant long-term transformation. Early applications include small-package delivery, the urgent delivery of medicines, the transport of medical supplies to remote areas, and robotic material handling within warehouses. The broader strategic significance of civilian applications lies in drones evolving from standalone vehicles into mobile sensors that generate data (Mohamed et al., 2020, pp. 1–3). In smart cities, for example, UAVs can provide data for traffic monitoring, inspections for unauthorized construction, environmental monitoring, and search and rescue operations. Their ability to generate real-time data and capture high-resolution imagery is making them an important component of the smart city ecosystem. In the future, drawing a clear distinction between the “drone industry” and “data production” will become increasingly difficult. The economic value of UAVs will derive both from their ability to fly and from the integration of the data they generate into decision-making systems.

9. THE STRATEGIC SIGNIFICANCE OF REMOVING OPERATORS FROM HIGH-RISK ENVIRONMENTS

The common feature of unmanned systems across air, land, and sea is the separation of human operators from the platforms they operate (Grossman, 2018, pp. 42, 74). This has far-reaching implications for both military and civilian applications. In aviation, removing the pilot from the aircraft changes the constraints imposed by fatigue during prolonged missions, reduces the risk of losing pilots, and can remove certain design constraints associated with protecting human life.

At sea, these advantages are even more pronounced (Nichols et al., 2020, pp. 148–149, 160–163). Using unmanned systems in mine-infested waters, near hostile shores, on prolonged underwater missions, or in high-risk reconnaissance areas protects personnel from harm. On land, robotic vehicles are particularly well suited to mine detection and clearance, reconnaissance in environments contaminated by chemical, biological, or radiological hazards, and logistics operations under enemy pressure.

¹²A georeferenced image with a uniform scale that can be used as a map. It is produced by mathematically correcting distortions in aerial photographs caused by camera tilt, perspective, and differences in terrain elevation.

The literature describes this advantage in terms of transferring “dull, dirty and dangerous” tasks to machines (Nichols et al., 2020, pp. 5–6, 162–163; Grossman, 2018, pp. 150–152). Removing human operators from the platform, however, does not mean removing them from the system altogether. Humans remain involved at various points as operators, commanders, intelligence analysts, software engineers, electronic warfare specialists, and decision-makers. The real strategic revolution will therefore lie in one person’s ability to control an increasing number of machines simultaneously.

10. AI-ENABLED AUTONOMY AND THE NEXT FRONTIER

Drone warfare today still relies largely on human-operated systems. However, AI is increasingly being used for image classification, route optimization, obstacle avoidance, target tracking, navigation in electronic warfare environments, and coordination across multiple platforms. The ability of AI-enabled autonomous systems to analyze data and carry out tasks with little or no human intervention will offer substantial benefits in healthcare, transportation, industry, and defense.

The next major shift will involve a single operator assigning tasks to multiple unmanned vehicles (Grossman, 2018, pp. 135–138, 150–157; Nichols et al., 2020, pp. 153–158). At lower levels of autonomy, human operators directly control vehicles and their routes. At higher levels, autonomous vehicles can plan routes around mission objectives, adapt to changing threats and environmental conditions, and complete their tasks with less human intervention. In subsequent stages, humans will define the overall mission objectives and constraints, while a “swarm” of unmanned vehicles will handle much of the task allocation, route planning, and coordination among its members. Future unmanned system architectures will be built around swarms, manned-unmanned teaming, multisensor integration, and autonomous coordination among air, land, and maritime components.

CONCLUSION

Unmanned and autonomous systems represent the next stage of the technological revolution that began with steam engines and continued with the internet. While the Industrial Revolution greatly increased the power of machines, the information revolution expanded the capacity to produce and share information. Advances in AI and robotics are now enabling machines to assume a growing range of responsibilities once performed by humans.

UAVs are the most visible example of this transformation today. Yet the world of the future will extend well beyond drones in the sky. Autonomous ground vehicles, unmanned maritime platforms, underwater robots, satellite networks, AI-enabled command and control systems, and swarms of unmanned vehicles will come together within a digital ecosystem.

The wars of the past two decades have revealed different stages of this transformation. ISIS demonstrated how nonstate actors could weaponize commercial UAVs. The Karabakh war showed the impact unmanned systems could have when integrated with conventional forces. As the October 7 attacks demonstrated, even a small UAV can be a powerful tool for disabling sensors. The war in Ukraine has seen extensive use of FPV drones and other unmanned aerial and maritime vehicles, while the Houthis have shown that inexpensive systems can disrupt global maritime trade. The conflict between the U.S., Israel, and Iran has extended the threat posed by UAVs and missiles beyond the battlefield to energy infrastructure, data centers, ports, airports, international trade routes, and even holy sites.

The situation in Ukraine also shows, however, that UAVs are not a universal solution to military challenges. Personnel, logistics, production capacity, training, electronic warfare, air defense, and military doctrine remain crucial. What is changing is how these elements interact. The future balance of power will not be determined solely by the question of “who has more aircraft, ships, or tanks?”

More consequential questions are likely to shape that balance. “Who can connect more sensors to a data network? Who can process data faster? Who can produce inexpensive technological systems at scale? Who can operate under electronic warfare conditions? Who can allocate tasks more effectively between humans and machines? Who can translate technological innovation into doctrine and a sustainable ecosystem?”

Viewing unmanned systems simply as “new weapons” will therefore be insufficient to understand the technological world ahead. A much broader transformation awaits, spanning military power, the global economy, urban governance, agriculture, logistics, and international law.

The next installments in this series will explore the technological revolution taking shape through the transition from crewed systems to the autonomous era. They will examine how drones are fundamentally changing the dynamics of combat on land, in the air, and at sea. The analysis will consider the substantial impact of low-cost technologies in asymmetric warfare and how these new tools are reshaping the global balance of power. Finally, it will examine in depth the debates surrounding ethics and accountability in the use of autonomous weapons.

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