

The Iranian Drone Threat

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Photo : Hassan Mousavi

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Introduction

Among the U.S.’s core interests in the Middle East are ensuring the security of its allies, combatting terrorism, countering arms proliferation, and ensuring freedom of navigation for global energy supplies and commercial shipping. Iran’s military Unmanned Aerial Vehicle (UAV) program is an emerging strategic threat that complicates the U.S.’s pursuit of each of the aforementioned regional security interests.

As a revisionist regional power, Iran’s overarching foreign policy objective is supplanting the United States to become the dominant military and political influence in the Middle East. This is a tall order for Iran’s revolutionary regime, presiding over a decaying theocratic and dictatorial political system plagued

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by endemic corruption and frequent civil unrest. Iran is a middling military power, [outpaced](#) by the U.S. and its regional partners in terms of military spending and personnel. Iran's conventional armaments are qualitatively inferior and out-of-date, with sanctions and an international embargo limiting Iran's access and ability to purchase upgraded systems or keep up with the latest technological innovations in fields such as air and missile defense.

Iran recognizes that it would be a waste of its resources to seek military parity with its U.S.-backed foes and has thus adopted low-risk, cost-effective measures to maximize its advantages when it comes to defending itself and spreading the Islamic Revolution.

One asymmetric arena where Iran has expended considerable investment is in Unmanned Aerial Vehicles (UAVs), or drones, giving Iran an additional means of lethal power projection outside of its borders. Iran is also providing UAV systems to its proxies who act on Tehran's behalf, further enhancing its ability to threaten the U.S. and its allies.

According to a November 2019 U.S. Defense Intelligence Agency [assessment](#) of Iran's military strength, "UAVs are Iran's most rapidly advancing air capability." UAVs serve two primary military functions, surveillance, and attack. Iran's capabilities in both continue to grow, spurred by increased investment in domestic drone manufacturing and technological advancements, and by accessible innovations in the commercial drone market. Drones help Iran make up for shortcomings in aerial reconnaissance capabilities and are used by Iran's conventional armed forces and the Islamic Revolutionary Guard Corps (IRGC) for intelligence, surveillance, and reconnaissance (ISR) applications.

In the past decade, Iran has also accelerated its efforts to develop indigenously designed and manufactured weaponized UAV systems and to transform its ISR drones into versatile platforms with integrated or suicide attack capabilities. In tandem with its missile arsenal, drones augment Iran's lack of conventional long-range airstrike capabilities and Iran has used UAVs in both offensive and retaliatory air-to-ground attacks. As its drone forces have grown in sophistication, they increasingly give Iran the ability to carry out strikes with precision. Still, [drones are considered to be at the lower end of military threats facing the U.S. and its partners](#), especially due to recent advances in air and missile defense. The threat increases, however, as Iran's drones grow increasingly sophisticated and it continues to experiment with drone swarms and combined drone and cruise or ballistic missile attacks in an effort to probe and beat air defense systems.

Drones have numerous advantages over manned strike platforms, which have added to their efficacy in Iran's asymmetric toolkit. They are less costly to build and maintain than manned combat aircraft and have fewer costs associated with training, as manned aircraft require pilots and crewmembers to operate. Iran has struggled to obtain parts to maintain its aging air force due to international sanctions but has succeeded in developing an indigenous drone capability as many of the systems, parts, and equipment for UAVs are more commonly commercially available and include numerous technologies with dual civilian-military uses. Drones can potentially have longer flight endurance, greater maneuverability, and lower observability than conventional combat aircraft.

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Iran's combat aircraft program has fallen so far behind the latest innovations in air defense that it would be prohibitively costly for Iran to catch up, to say nothing of the procurement hurdles it would face. Drones represent a far cheaper and easier alternative to develop and, as an added advantage, are a platform that is more difficult for the U.S. and its allies to defend against. Since the end of the Cold War, the U.S. military has largely oriented its research and strategic planning toward air defense systems intended to counter medium and long-range high-altitude, fast-moving threats, such as ballistic missiles. While there are now at least [12 Patriot missile batteries and one Theater High Altitude Area Defense \(THAAD\) battery](#) in the region to protect U.S. military assets and allies from longer-range aerial threats, the layout of U.S. air defense systems has created [short-range coverage vulnerabilities](#) that Iran has used low-flying drones and cruise missiles to exploit.

The current air defense systems in place have proven capable of neutralizing drones at times when called upon but have also had several failures as they are not ideally situated to protect a country like Saudi Arabia with expansive territory and long coastlines. Further, it is costlier to defend against drones with air defense systems or fighter jets than it is for Iran to produce, maintain, and operate them. A single Patriot surface-to-air missile can cost between \$2-3 million, making defending against a drone swarm an extremely expensive proposition.

Drones also serve a domestic and external propagandistic purpose for the Iranian regime in addition to their military applications. Their use in combat operations signals to enemies that Iran is able to project strength around the region using the latest military technologies, even in the face of an international sanctions regime and arms embargo. They are, therefore, a symbol of national pride and resilience. Iran frequently displays its advances in defense technologies in military parades and defense exhibitions, and drones have become a focal point. Iran often [inflates](#) the true depth of its military achievements, making it hard to separate fact from fiction at times when Iran describes the capabilities of its drone systems. This strategic use of misinformation is meant to deter adversaries from engaging in hostilities with Tehran by increasing their threat perception and signaling the Iranian public that the regime has the means and ability to provide for defense of the homeland.

While it is therefore difficult to gauge the full scope of the Iranian drone threat, Iran's use of drones in various combat operations in recent years has demonstrated a rapid advancement in capabilities that pose a tactical threat to the U.S. and its Middle Eastern allies. Addressing the U.S. Senate Armed Services Committee, CENTCOM commander Gen. Kenneth McKenzie [warned](#) that UAVs represent "the most concerning tactical development in the CENTCOM area of operations since the rise of the improvised explosive device." Iran has used drones to harass U.S. air carriers and threaten freedom of navigation in the Persian Gulf and the Gulf of Oman, gain military advantage in the Syrian and Iraqi conflicts, and breach Israeli and Saudi airspace. The clearest illumination of the Iranian drone threat came in September 2019, when Iran [is believed to be culpable for a series of missile strikes and a drone swarm](#) that carried out precision attacks against Aramco's Abqaiq oil processing facility and Khurais oil field in Saudi Arabia.

Yemen's Iran-backed [Houthi rebels](#) claimed credit for the Abqaiq attack, a claim the U.S. [disputes](#). However, it is indisputable that the Houthis have created an upstart drone program and that Tehran provides its drones. A March 2017 [investigative report](#) from Conflict Armament Research found that the

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Houthi Qasef-1 drone featured identical design, construction, and serial number prefixes as the Iranian Ababil-T, indicating that the Houthi UAVs were direct Iranian imports.

Iran's provision of weaponized drones to the Houthis highlights another facet of the Iranian drone threat, namely that Iran is proliferating drones and related technologies to its terrorist and militia proxies in violation of U.N. Security Council resolutions. Iranian proxies, most notably Hezbollah, Hamas, the Houthis, and Iran-backed Iraqi Shia militias, have all benefitted from Iran's technical drone know-how and possess drones either manufactured in Iran or based on Iranian models. The provision of drones to its proxies gives Iran increased ability to threaten the U.S. and its regional allies. As Iran's own drone expertise increases, its proxies' capabilities are likely to grow as well.

Iran's military drone program is an important component in its growing footprint around the Middle East. Tehran and its proxies are using drones with increasing frequency to confront the U.S. and its allies. Iran is still essentially in the early stages of using drones for attacks rather than just surveillance, but the Abqaiq attack demonstrated that Iran has gained the ability to carry out complex, integrated drone swarm and missile attacks. As Iran and its proxies grow increasingly proficient in these tactics, they may seek to undertake crippling strikes against adversaries' critical infrastructure or sensitive facilities, such as oil storage and nuclear reactors. Containing Iran's regional hegemonic ambitions will require the U.S. and its regional allies to bolster their collaborative defenses against the Iranian drone threat.

This report analyzes the history and capabilities of Iran's drone program, the malign use of Iranian drones in the region, and the regime's provision of drones and drone technology to its proxies. It concludes with actionable policy recommendations on how to combat this emerging threat.

History and Capabilities of Iran's Combat Drone Program

Iran has built up an arsenal of locally produced drones and exported drone technologies to its allies, enhancing Tehran's ability to threaten the U.S. and its Middle Eastern allies. From the 1980s to the present, Iran has continuously advanced its military UAV program, seeking to improve its fleets' intelligence, surveillance, and reconnaissance capabilities and to field UAVs able to carry out airstrikes. In the last decade, in particular, Iran has unveiled numerous new drone systems, many of which have been used in combat, demonstrating the advancements Iran has made in the UAV space. Iran now claims to have drones capable of delivering precision-guided missiles with ranges of 2000 km., flight endurance over 24 hours, and stealth capabilities. While its boasts are often exaggerated for propagandistic purposes, the advancement of its drone program represents a technological triumph for the Islamic Republic.

Understanding the history, evolution, scope, and capabilities of Iran's drone program is vital for policymakers wishing to contend with the Iranian drone threat.

Mohajer: The genesis of Iran's drone program dates back to the 1980-1988 Iran-Iraq War. After the founding of the Islamic Republic of Iran in 1979 and the subsequent hostage crisis, Iran was newly isolated on the world stage from its traditional allies and arms suppliers, particularly the United States, which severed military and diplomatic relations with the new regime. As a result, Iran's military

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procurement strategy heavily emphasized self-sufficiency, a trend that remains prevalent in the present day. At the height of the war, Iran sought a way to rein in the large number of casualties it was sustaining and looked to drone surveillance of enemy positions as an avenue for mitigation. In 1985, the IRGC formed the Quds Aviation Industry Company as a wing of its Self-Sufficiency Organization, and later that year, it developed Iran's first drone, the [Mohajer-1](#) (Immigrant).

The Mohajer-1 was unsophisticated in design and was fitted with a single oblique camera in its nose, likely a still camera whose film would be developed upon recovery. Iran used the drones in the later stages of the war to photograph Iraqi infantry positions in preparation for offensives and yield intelligence that would prevent Iranian troops from walking into ambushes. Tehran also reportedly attempted to outfit the drones with rocket-propelled grenade (RPG) launchers under each wing, but it is unclear whether Iran carried out drone attacks during the war. These early armaments would likely have been ineffective and inaccurate, as they would rely on the drone operators' line of sight from their position on the ground. While the use of the Mohajer-1 did not majorly impact the outcome of the war, the early experience in drone production and primitive attempts to arm them laid the institutional groundwork for Iran's development and use of combat drones in subsequent decades.

Beginning in the 1990s, Iran developed several new variants of the Mohajer, with later iterations boasting increased range and flight endurance. Iran also continued efforts to transform the platform from an ISR drone into one with viable attack and air-defense capabilities. A later model, the Mohajer-4, was capable of being equipped with air-to-air [QW-1 MANPADS](#), for instance, which would give it the ability to confront enemy aircraft in midair. Iran upgraded the Mohajer's surveillance capabilities as well, as later iterations were capable of providing real-time video footage.



Mohajer-6 ([Wikipedia](#))

The Mohajer-2, first observed in 1996, had a range of 50 km. and an endurance of 1.5 hours. The newest version, the Mohajer-6, which was first announced in 2016 and went into mass production in 2018, demonstrates the rapid advancements Iran has made in drone technology in recent years. According to the Iranian Ministry of Defense and Armed Forces Logistics (MODAFL), the Mohajer-6 has a [range of 200 km. and an endurance of 12 hours](#). It is a persistent ISTAR (Intelligence, Surveillance, Target Acquisition, and Reconnaissance) UAV, [meaning](#) that its operators have the integrated capacity to process the raw intelligence data collected through surveillance and

reconnaissance in real-time in order to plan and develop military operations, such as where precisely to carry out missile strikes. The Mohajer-6 is manufactured by the [Iran Aviation Industry Organization](#) (IAIO), which operates under the command of MODAFL. IAIO [absorbed the Quds Aviation Industry Company](#) in March 1998.

MODAFL [claims](#) the Mohajer-6 “can be equipped with laser-guided missiles and different types of bombs to carry out offensive operations,” making it the first drone in the Mohajer class capable of being armed with a guided weapons system. According to [Iranian Defense Minister Amir Hatami](#), “Drone

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Mohajer-6, equipped with the smart Qa'em precision-striking bombs and different electro-optical explorers and different warheads, can trace, intercept and destroy the target.”

Upon receiving its first batch of three Mohajer-6s in July 2019, Brigadier General Shahram Hassennejad, head of the army ground force's drone unit, noted, “With the deployment of these unmanned aerial vehicles, any threat to the Iranian borders and even beyond the borders, will be identified, tracked down and removed before it could even take form.”

There are numerous reported uses by Iran's regular army and the IRGC of Mohajer variants in the decades following the Iran-Iraq War both inside and outside the country and surrounding waterways. An early model of the Mohajer was used on [reconnaissance missions in Afghanistan](#) during that country's civil war during the late 1990s. Later models have been used for maritime surveillance of warships transiting the Strait of Hormuz and enforcing internal and border security by the regular army and IRGC, particularly in restive provinces with militant separatist groups, such as Sistan and Baluchestan. The Mohajer-6 has reportedly been used against al-Qaeda affiliated [Jaysh ul-Adl](#) militants, and in July 2019 was used in a [retaliatory attack on Kurdish dissidents](#) in Iraq after an attack that killed three IRGC soldiers. Beyond achieving its immediate objectives, Iran's use of the Mohajer-6 in military operations was likely meant to showcase its advancements in drone capabilities to its adversaries and to prove to potential buyers that the system is combat tested.

Mohajer UAVs have been used in operations in neighboring countries and represent a proliferation risk as Iran has provided them to its proxies. Iran has [sold Mohajer variants to Hezbollah](#), likely using Syria as a transshipment point, and the terrorist group has infiltrated Israeli airspace with them on several occasions as of 2004. Beginning in 2007, Iran, as part of its efforts to bolster ties with U.S. adversaries in the western hemisphere, [exported kits](#) to the Venezuelan government of Hugo Chavez for the assemblage of early-generation Mohajer-2 ISR drones. As of 2013, Venezuela's air force was believed to have roughly a dozen Mohajer-2s, known locally as the Arpia, in operation. Mohajer variants are also reported to have been used during the [conflicts in Iraq and Syria](#), particularly in the fight against ISIS, although it is not clear what forces, be they Iran-backed militias or Iran itself, have been operating them. Their use in these conflicts is known because Mohajers were downed in Syria and Iraq on several occasions during 2014 and 2015.

Ababil: After first building and flying the Mohajer-1 during the Iran-Iraq War, Iran built lines of other indigenously produced UAV systems. One of the earliest systems, the Ababil (Swallow), was also reportedly designed and manufactured during the later stages of the Iran-Iraq War, although it is [not known with certainty if Iran used the Ababil](#) during the war. According to Iranian [IRGC-linked media](#), the Iran Aircraft Manufacturing Industry (HESA) began mass production of the original Ababil-1 in September 1986. Like the Quds Aviation Industry Company, HESA is a subsidiary of IAIO under the command of MODAFL.

The original Ababil-1 was reportedly a loitering munition – a weapons system that would hover searching for a target and attack upon finding one – that effectively functioned as a suicide drone. The Ababil-1 was considered disposable and was capable of carrying 40 kg. of explosives, which would detonate upon impact. If used during the Iran-Iraq War, it likely would have only been effective against

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Iraqi defensive positions and fortified reinforcements instead of personnel or other soft targets due to the lack of fragmentation.

During the 1990s, HESA set about reengineering the Ababil, subsequently releasing and mass-producing several new evolutions of the UAV. The second generation, the Ababil-2, was publicly unveiled for the first time in 1999. It has several [variants](#) for different purposes. The Ababil-B is a targeting drone used for training air defense crews by mimicking enemy aircraft, while the Ababil-S is a surveillance drone that shares the same airframe as the Ababil-B, but also has an electro-optical payload. The Ababil-S' surveillance capabilities are considered [rudimentary](#) due to its short flight endurance time, and the fact that it can only operate daylight TV cameras due to weight and size limitations.

A third variant, the Ababil-T, is characterized by twin tails, which IRGC-linked [media](#) claims gives it increased speed and range. The Ababil-T can be outfitted with payloads for targeting, surveillance, and disposable strike munitions for use in suicide missions. The Ababil-B has been used frequently by the IRGC and regular Army for targeting purposes, but the surveillance and twin-tailed models are not known to have been used operationally by Iranian forces. Iran has reportedly provided Ababil-Ts to [Hamas](#), [Lebanese Hezbollah](#), and [Yemen's Houthi rebels](#), however, and the proxies have employed them against Israel and Saudi Arabia. Hezbollah calls its Ababil-Ts the Mirsad 1, while the Houthis have named it the Qasef-1. The Houthis have also created an upgraded variant called the Qasef-2k.

Reflecting Iran's advances in drone capabilities over the last decade, Iran's newest-generation Ababil, the Ababil-3, is an ISR drone with far more sophisticated surveillance capabilities than its predecessor. The Ababil-3 shares similar design characteristics and components as [South Africa's Denel Dynamics Seeker](#), indicating Iran may have received Seekers at some point and began locally producing its own version or even just rebadged the Seekers as Ababil-3s. It has a range of 100 km. and a flight endurance of four hours. The Ababil-3 went into production in 2008 and first appeared in use not in Iran but by the [Sudanese government](#) later that year for surveillance and precision targeting in the conflict in southern Sudan. The Ababil-3 was [first displayed](#) by Iran during a military exercise simulating reconnaissance of vessels transiting the Persian Gulf in May 2010. It has since been used by Iran in various conflict zones, most frequently in Syria. In 2014, two Iranians, one of whom also had German citizenship, were [charged](#) in Germany for a 2008-2009 scheme to circumvent trade sanctions with Iran by declaring 61 German Limbach engines as jet ski engines in order to pass through customs. A court statement noted that the engines were suitable for use in Ababil-3s. The incident highlights one of the enduring challenges facing Iran's drone program, its reliance on Western components, particularly engines, subject to embargoes. Because of these hurdles, it is believed that Iran may have turned to a [Chinese-sourced knock-off](#) of the Limbach engine for use in its Ababil-3s.

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Atlas carrying Qa'em guided bombs ([Tasnim](#))

In April 2020, at a ceremony marking Army Day, Iran [displayed several new UAV systems, which it delivered to its army](#) for the first time. Among the systems which the army's air force and air defense units took delivery of was an upgraded Ababil-3. The Ababil-3 is now reportedly [mounted with Qa'em precision-guided bombs](#), indicating that Iran has converted the Ababil from an ISR drone to one with combat capabilities. While Iran has produced several drone systems over the past decade specifically for combat purposes, the conversion of the Ababil-3, like the Mohajer-6 before, shows that Iran is focused on upgrading ISR platforms into drones with integrated attack capabilities. Iran also unveiled an upgraded version of the Ababil-3 called the [Atlas](#) at the Army Day ceremony. The

Atlas has a similar body to the Ababil-3 but boasts an improved landing mechanism, hydraulics, and an automatic takeoff and landing system. The Atlas's body and wings have also been fortified to allow it to carry two Qa'em bombs.

Karrar: Iran's dedicated effort to indigenously produce attack drones began in earnest during the mid-2000s and bore fruit between 2010 and 2020, a decade that witnessed Iran unveil various new combat UAV platforms. The first of these that Iran revealed was the Karrar (Striker) in 2010, which was also one of the drones on display at the 2020 Army Day ceremony. Billed by Iran as its first long-range UAV with dual strike and reconnaissance capabilities, the Karrar was characteristic of Iranian military bluster, as the UAV's claimed attack capabilities were almost certainly [oversold](#) by Tehran.



Photo : Mehdi Ghasemi

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Karrar ([Wikimedia Commons](#))

Underscoring that the Karrar's primary utility to Iran was as a propaganda tool, the UAV was unveiled a day after Iran inaugurated the Bushehr nuclear reactor, signaling to adversaries that Iran had arrived as a nuclear and military power on the regional stage. In a ceremony to introduce the new UAV, then-President Mahmoud Ahmadinejad declared that while Iran's primary message was one of friendship to the region and that the drone was meant to deter enemies from attacking Iran, the Karrar would serve as "[a messenger of death for enemies of mankind.](#)" State television [declared](#) at the time that the Karrar had "different capabilities, including carrying bombs to destroy

targets" and could fly for a "long-range at high speed." Then-Defense Minister Ahmad Vahidi [said](#) that the Karrar is a "symbol of the versatility and advancement of Iran's defense industries."

The Karrar, manufactured by HESA, is a rudimentary UAV powered by a single turbojet engine whose design [combines aspects](#) from U.S. Beechcraft targeting drones exported to Iran pre-Islamic Revolution and South African Denel Dynamics Skua high-speed targeting drones. Iran [claimed](#) that the Karrar has a

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range of 1000 km., can operate at high or low altitudes, and can carry two 250 lb. bombs or one 500 lb. guided missile. Carrying such heavy ordnance under its wings or atop its centerline would [greatly reduce its operational range](#), however. Since its introduction, the Karrar mainly appears to have functioned almost exclusively as a [targeting drone](#) for Iran's air-defense systems and not as a "striker," as its name suggests. Nevertheless, at the April 2020 Army Day ceremony, Iran's Defense Minister Amir Hatami [claimed](#) that the Karrar was capable of carrying out air-to-ground strikes and that the drone had been upgraded for use on suicide missions, effectively acting as a cruise missile. Given Iranian officials' penchant for distorting their military technological prowess, these claims cannot be verified and should be regarded with skepticism until they are verified in combat.

In November 2020, the Islamic Republic News Agency [reported](#) that the Karrar successfully dropped 500 lb. bombs on ground targets during military drills, indicating that the platform may be closer to being operationalized in a striking capacity in combat settings.

Shahed-129: In September 2012, two years after introducing the Karrar, Iran unveiled the Shahed-129 (Witness), a substantive step forward in terms of Iran's effort to develop a strike-capable combat UAV. Up until that point, Iran's drone fleet consisted exclusively of smaller aircraft with short ranges and flight endurance. This was largely due to sanctions and export control regimes preventing Iran from acquiring technologically sophisticated dual-use components for larger, more lethal drones, as such components would set off alarm bells. Iran sought to manufacture as many of its drones as it could domestically and was able to get the components it needed, such as German Limbach engines, from arms brokers for a markup, or through [schemes](#) such as establishing front companies which would ship components to IAIO with fraudulent shipping labels.

By 2012, Iran claimed to have made advances in its indigenous engine production capabilities, and the rollout of the Shahed-129 that September seemed to confirm this, although Iranian officials almost certainly exaggerated the new drone's capabilities. The Shahed-129 is a medium-altitude long-endurance (MALE) unmanned combat aerial vehicle (UCAV) with combat, intelligence, surveillance, and reconnaissance (CISR) functionality. It is believed to be modeled after the Israeli [Hermes-450](#), a drone that Iran had previously claimed to have [captured](#) and potentially reverse-engineered. IRGC officials [boasted](#) that the Shahed-129 had a range of 1700 km., a flight endurance of 24 hours, and was capable of carrying up to eight Sadid guided air-to-ground missiles.



Shahed-129 ([Wikimedia Commons](#))

IRGC officials heralded the Shahed-129 as a symbol of Iran's advances in UCAV technology. The drone, designed by the IRGC's Shahed Aviation Industries and manufactured by HESA, went into mass-production a year later, and the IRGC's then-Commander-in-Chief Maj. Gen. Mohammad-Ali Jafari marked the occasion by [claiming](#) the Shahed-129 demonstrated Iran had achieved self-sufficiency in its UAV industrial sector. "This aircraft is a work of art, only the U.S. has the ability to build weapons of such a technological grade. All the world powers will be awestruck," [said](#) Jafari. Brig. Gen. Amir Ali Hajizadeh, commander of the IRGC

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Aerospace Division, which also controls Iran's ballistic missile program, [stated](#) at the time, "The Shahed 129 [UAV] can easily track and identify bandits, terrorists and drug smugglers as well as anyone targeting the Islamic Republic of Iran's sustainable security and can fire missiles at them upon orders from commanders."

Analysts, however, had doubts that the Shahed-129, at least in its earliest iteration, could actually function as a fully integrated combat UAV system. Iran released a [video](#) marking the 2012 debut of the Shahed-129 showing the drone in flight launching a missile, but the footage then quickly cut to a new scene of a missile striking a target, casting doubt that the UAV actually possessed precision-strike capabilities. Israeli [analysts](#) further noted that the Sadid missiles in early images of the UAV were not enclosed in canisters, which would expose their sensitive electronics systems to weather conditions in flight that could cause malfunction. Despite its supposed range of 1700 km., the early Shahed-129 lacked communications capabilities and was reliant on a ground operator, which, based on its datalink, would have limited its operational range to [around 200 km.](#)

Seemingly affirming its lack of strike capability, a drone believed to be the Shahed-129 began [appearing in the Syrian civil war](#) around Damascus in 2014, but was initially not witnessed carrying arms. The drone in question may have been a Shahed-123, a smaller, unarmed variant. By late 2015, however, Iran made a series of upgrades to the Shahed-129, which enabled it to fulfill its potential as a combat UAV capable of delivering air-to-ground missiles. Because of [procurement issues due to sanctions](#), Iran's research and development into the Sadid-1 was not completed as of 2016 and the missile was not integrated or operationally deployed with the Shahed-129. Iran instead developed a new munition, the [Sadid-345](#), a precision-guided glide bomb, which became the Shahed-129's primary weapon. In February 2016, Iran also [unveiled](#) an upgraded version of the Shahed-129 with which Iran claimed had satellite navigation capabilities, a claim which, if true, would increase the drone's operational range and reduce reliance on ground-control operators, marking a big leap forward for Iran's drone program. As Iran has, at times, struggled to successfully launch satellites, however, this claim is dubious. By late 2015, Iran carried out its [first air-to-ground strikes](#) using the Shahed-129 in Syria, demonstrating for the first time in combat that Iranian UCAVs were capable of air-to-ground missile strikes.

Iran notes that the Shahed-129 is additionally used for reconnaissance and patrolling its territorial and maritime borders. It is known to use the Shahed-129 to patrol along its border with Pakistan in Sistan and Baluchestan province, an area known for drug smuggling and home to an armed separatist movement. In 2015, a Shahed-129 [crashed](#) on the Iranian side of the border with Pakistan, and in 2017, Pakistan shot down a Shahed-129 that [reportedly](#) crossed 3-4 km. into its airspace.

The Shahed-129 is today Iran's most combat-tested UCAV platform and one of the only systems in Iran's arsenal to have proven capabilities of conducting air-to-ground missile strikes. In December 2019, Iran's navy [unveiled the Simorgh](#), the Navy's version of the Shahed-129.

Saeqeh: The IRGC officially revealed the first Saeqeh, manufactured by Shahed Aviation Industries, in October 2016 at a [defense expo](#) showcasing Iran's advances in the UAV arena. However, the system's true genesis dated back to December 2011, when Iran [recovered](#) a downed U.S. Lockheed Martin RQ-170 Sentinel stealth UAV intact with minimal damage.

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The 2011 incident was a major propaganda and substantive victory for Iran. The IRGC claimed to have hacked and taken over the controls to bring down the \$6 million UAV, which originated from a U.S. military base in Kandahar, Afghanistan, and whose presence demonstrated that the U.S. was conducting covert surveillance of Iran's nuclear program. It is more plausible that the Sentinel was not, in fact, detected by the IRGC and instead crash-landed due to a system malfunction. The intact drone possessed many technological secrets, such as stealth capabilities, sophisticated electronics, and Iran was able to [extract video footage](#) that the drone had recorded.

Iran claimed, plausibly, that Russia and China had [asked for permission to inspect the downed drone](#). Immediately thereafter, Iran set to work seeking to reverse-engineer the drone so that it could indigenously produce its own version. In May 2014, it presented a [crude mock-up](#) of the RQ-170, believed to be constructed of fiberglass, at an aerospace exhibition in Tehran and attempted to pass it off as a functional stealth UAV with added attack capabilities. Notably, the model had identical tires and landing gears to the captured RQ-170, parts Iran would not have had access to. The model, which was displayed alongside the actual captured aircraft, was a full-size replica of the RQ-170 dubbed by Iran the [Shahed-171](#). Despite the fakery, an IRGC officer [claimed](#) on state TV at the time, "Our engineers succeeded in breaking the drone's secrets and copying them. It will soon take a test flight." Surveying Iran's latest achievement, Supreme Leader Khamenei [remarked](#), "This drone is very important for reconnaissance missions."

In November 2014, Iran released video footage that it claimed showed its supposed RQ-170 clone in flight. The aircraft portrayed, however, was far [smaller than the RQ-170](#). As mentioned above, the IRGC officially [unveiled the Saeqeh](#) (later known as Saeqeh-1), a [smaller version of the RQ-170 that retained the original's wing-shape, but lacked its frontal air intake](#), in October 2016. It is possible that the drone on display in 2016 was the same model as the drone from the November 2014 flight video footage. Iran billed the Saeqeh-1 as a long-rangeUCAV capable of externally carrying four electro-optically precision-guided Sadid-1 anti-tank missiles. With characteristic bluster, IRGC Aerospace Commander Brig. Gen. Amir Ali Hajizadeh [proclaimed](#) that Iran's drone industry was now among the world's top four and that Iran has better aviation systems and equipment than the U.S.



Saeqeh-2 ([Wikimedia Commons](#))

Although it was never formally unveiled, Iran apparently possesses a [newer variant of the Saeqeh](#), known as Saeqeh-2 or Shahed-191, and has displayed it at [defense expos](#). The IRGC conducted a [drone war game](#) in March 2019 that featured 50 drones based on the RQ-170, indicating that Iran has produced a large number of Saeqehs in a relatively short period. The war game was called "Toward Jerusalem," highlighting that Iran views its drone prowess as an integral component of its long-term desire to liberate Israel from Zionist control.

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According to Iranian state media, all the UCAVs involved in the exercise successfully bombed a target on an island in Iran's territorial waters in the Persian Gulf. If true, this claim would corroborate Iran's purported UCAV precision-strike capability. According to Jeremy Binnie of Jane's Defence Weekly, the exercise [confirmed](#) that Iran has propeller (Saeqeh-1) and jet-powered (Saeqeh-2/Shahed-191) variants of the Saeqeh. Both variants are launched from vehicle-mounted racks off pickup trucks speeding down a runway.

The Saeqeh-1 carried its ordnance externally and landed on fixed bars, while the Saeqeh-2 had an internal bay for carrying weaponry and landed on retractable skids. The Saeqeh-2's innovations would make it an inherently stealthier craft. The Saeqeh-2 is [reported](#) to have an operational range of 450 km. and flight endurance of 4.5 hours, with a top speed of 300 km./hr. It can reportedly carry a 50 kg. payload, enough for two Sadid smart bombs.

Yasir: The RQ-170 Sentinel is not the only U.S. drone Iran claims to have captured and subsequently reverse engineered. In December 2012, the IRGC [claimed](#) that it hijacked a Boeing ScanEagle UAV conducting an ISR mission in its airspace over Kharg Island, off Iran's southern coast in the Persian Gulf. The [ScanEagle](#) is a small, low-cost ISR UAV with a wingspan of 10 feet, a flight endurance of 20 hours, and a range of over 100 km. The IRGC released footage of the captured drone, which appeared to have sustained only minimal damage. For its part, the U.S. Navy [denied](#) that it had lost any drones on recent missions in the region, but intimated that it had lost some in the Gulf waters in the past. It is also possible the captured drone belonged to a U.S. ally, as the UAE, Canada, and Australia also use the ScanEagle and are active in the Gulf.



Photo : Armin Karami
[Yasir \(Wikimedia Commons\)](#)

Later in the month, the IRGC [claimed](#) that it had previously captured two additional ScanEagles, although it offered no details to back that assertion. The IRGC moved quickly to reverse engineer the ScanEagle and claimed to have already launched a production line to indigenously manufacture ScanEagle knock-offs. Less than a year later, in September 2013, the Iranian Army Ground Force [unveiled](#) the Yasir, Iran's domestic version of the ScanEagle. A high-ranking Russian military delegation [attended](#) the unveiling, indicating Iran may have shared its insights into the captured American technology with Russia. Iran referred to the Yasir as a combat drone, and the Army Ground Force commander [noted](#) that

"One of the capabilities of Yasir is detection and targeting of remote targets."

The Iranian made several modifications to the ScanEagle's design for the Yasir, such as "[adding a twin-tailboom empennage and an inverted v-tail](#) elerudder." Iran [claimed](#) that the Yasir had a flight endurance of 8 hours and a range of 200 km. Within several months of its inauguration, the Yasir was reportedly [spotted](#) in use in the Syrian civil war. Iran is believed to have provided the Yasir to several of its proxy militias active in Syria and Iraq, [including](#) Katai'b Hezbollah, Harakat Hezbollah al-Nujaba, and Katai'b Jund al-Imam. In January 2015, an IRGC Ground Forces commander remarked that Iran had

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modified the Yasir for use in [suicide combat operations](#), although there is no indication that the Yasir has been used in this way to date.

Recent Drone Developments

It is often difficult to separate fact from fiction when it comes to Iran's combat UAVs, as Iran tends to exaggerate its capabilities for psychological effect. Regardless, the systems enumerated above illustrate the advances Iran has made in recent years in upgrading its ISR capabilities and developing lethal drones capable of suicide operations and air-to-ground strikes. While its claims to rival the U.S.'s capabilities are bluster, when it comes to the drone arena, "just enough" can often be excellent. Iran has demonstrated that its drones are more than adequate to fulfill its combat objectives and to tactically threaten the U.S. and its regional allies, necessitating increased investment in air-defense systems to counter the Iranian threat.

Reflecting the growing centrality ofUCAVs in Iranian military doctrine, the IRGC has in recent years stood up a [division within its ground forces dedicated to drones](#). In April 2020, the commander of the IRGC's drone division, Akbar Karimloo, gave a detailed and candid interview with Tasnim News about Iran'sUCAV capabilities. In the interview, Karimloo stated his belief that "It is expected that the UAVs will be the best weapon and system in the future and in the service of the world's armed forces as well as the armed forces of our beloved country. With the least cost and loss, valuable information can be obtained from operational areas in the shortest possible time." Karimloo noted that Iran's advancing drone surveillance capabilities have greatly improved its intelligence gathering, providing superior images of topography and enemy positions to traditional satellites. Iran has used drones for surveillance along its own borders to monitor insurgent groups and further afield in the "resistance front," conflict zones such as Iraq and Syria, where Iran has sought to entrench militarily. Iran is increasingly seeking to employ integrated drone and missile attacks, with drones playing a role both in surveillance and target selection, as well as dropping ordinance themselves.

Another takeaway from the interview was that Iran is continuing to invest in training and communications technology in order to continue advancing itsUCAV program. Iran is also constantly seeking to improve the range and lethality of its drones. It is no surprise, then, that Iran has [continued](#) to unveil a stream of new systems since 2019, although its recently announced drone systems have yet to be seen in action, and therefore Iranian claims about their capabilities have not yet been independently verified.

In October 2016, the IRGC announced it had developed a drone primarily for maritime surveillance, which could be laden with explosives and used as a "[suicide drone](#)." The drone was pictured in an office environment atop a Persian carpet. There are no documented instances of the suicide drone in flight or in use operationally.

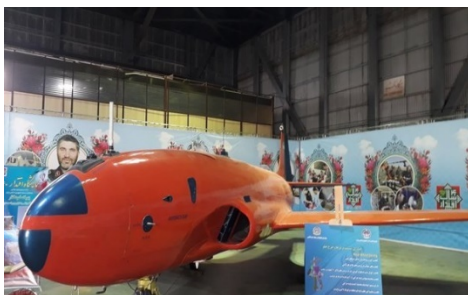
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Kaman-12 ([Wikimedia Commons](#))

In January 2019, Iran [unveiled](#) a new UAV called Kaman-12 (Expedient) ahead of celebrations of the 40th anniversary of Iran’s Islamic Revolution and in March [inaugurated](#) a production line for manufacturing the new system. Iran claimed the drone is a combat drone with a flight endurance of ten hours, an operational range of 1000 km, and the ability to carry a 100 kg. payload. It is [believed](#) the Kaman-12 resembles Israel’s Heron UAV and will be primarily used for long-range surveillance missions. The Kaman-12 likely does not have air-to-ground strike capabilities, and its payload is believed to have avionics and an EO camera rather than ordinance based on the lack of hardpoints on its wings.

In January 2019, Iran also [unveiled](#) the Khodkar (Automatic), a drone based on an outmoded design that was [mocked](#) and held up as evidence of Iran’s frequent dubious claims about its military technology capabilities. Iran claimed the Khodkar is its first wide-body UAV, capable of long-range surveillance and combat missions. According to Iran, the Khodkar is equipped with two cameras and antennas for U.S.-based GPS and Russian-based GLONASS satellite navigation. The design for the Khodkar is effectively an unmanned modification of a 1940s era Lockheed Martin T-33 Shooting Star jet trainer.



Khodkar ([Mehr News](#))

The T-33, which has been out of production since 1959, is not a wide-body aircraft, casting doubt on Iran’s description of the Khodkar. Iran had acquired several dozen T-33s on the second-hand market during the Shah’s reign. The most significant modification to the Khodkar included a General Electric J55 turbojet engine, the same engine used in Northrop Grumman F-5 fighter jets. Iran has several operational F5s still in its arsenal from the Shah’s era, and it is likely that the Khodkar’s engine was transplanted from one of those. Unless Iran is able to domestically produce an engine, Iran will likely not be able

to mass produce the Khodkar. Given the UAV’s bright orange paint job, it is more likely that if there is more than one Khodkar in existence, the drone would be used to target exercises rather than surveillance or combat missions.



Kian ([Tasnim News](#))

In September 2019, the Iranian army’s air defense force [unveiled](#) a new jet-propelled drone called the Kian, which it claims is for ISR, combat and air defense missions. According to the air defense commander, there is a high-speed variant of the Kian useful for reconnaissance and air interception missions, and a variant with a longer flight endurance “designed to carry out bombings with pinpoint accuracy.” Iran [claimed](#) the Kian has an operational range of 1000 km., and the air defense force commander also remarked that the Kian could hit targets far from Iran’s borders; a veiled warning to Israel and other regional adversaries.

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On April 26, 2020, the commander of the IRGC Ground Force's Drone Division, Akbar Karimloo, [announced](#) that his unit would soon take delivery of a UCAV called Fotros from the defense ministry. This was a significant announcement tucked away in his interview with Tasnim News which, if true, will represent a major advancement for Iran's UCAV capabilities. The Fotros was first [unveiled](#) – with much fanfare at the time – at a ceremony in Tehran in November 2013. Produced by HESA, the Fotros was said to be the largest UAV in Iran's arsenal and to possess "special specifications that make it stand out from other drones." Iran [claimed](#) the Fotros was capable of precision-firing Sadid-1 air-to-ground missiles using a laser designator, had a flight endurance of up to 30 hours, a flight ceiling of 25,000 feet, and an operational range of 2000 km., placing Israel within range from the Iranian homeland.



Fotros ([Wikimedia Commons](#))

It has not been possible to date to verify Iran's claims, but many analysts have questioned them. When it initially unveiled the Fotros in 2013, Iran seemingly rushed to display a prototype to coincide with the start of the P5+1 nuclear negotiations in order to gain leverage. Notably, the Fotros Iran displayed was [missing two screws](#) in its fuselage. While Iranian media articles made sporadic mention of the Fotros as one of Iran's primary long-range, long-endurance attack drones (along with the Shahed-129 and Mohajer-6), it was only ever witnessed in flight taking off and landing in a [propaganda video](#) and has not been observed in any operational combat theater. The Fotros was believed to be an [abandoned project](#) based on its long absence. If the April 2020 announcement that Iran will soon operationalize the Fotros comes to fruition, it would be a rare, albeit belated, instance of validation of Iran's propaganda claims.

In January 2021, Iran's conventional army [announced](#) it would hold a large-scale drone exercise in which it would "carry out various combat, surveillance, reconnaissance, and suicide missions in various flight ranges from short-range to long-range." According to the army's public relations arm, new "UAV equipment, achievements, and subsystems" will be unveiled for the first time in a related defense exhibition.

Iran's Malign Drone Usage

As Iran's drone attack capabilities have grown in recent years, Iran has become increasingly assertive in undertaking malign drone activities in the context of its hegemonic campaign for regional influence. In recent years, Iran has used its drones on numerous occasions to harass the U.S. naval presence in the Persian Gulf. It has also used the conflicts in Syria and Iraq as testing grounds for its drone technology, conducting ISR and strike missions to protect the Assad regime, further its interests in Iraq, and in the fight against ISIS. As it has sought to militarily entrench in Syria, Iran has also established drone storage and command outposts, bringing its combat UAVs in closer proximity to Israel.

U.S. Naval Encounters

According to an unnamed U.S. official in July 2019, Iran [flies two to three surveillance drones over the Gulf waters per day](#) as part of its efforts to monitor the strategic Strait of Hormuz. A November 2019 [assessment](#) of Iran's military capabilities by the U.S. Defense Intelligence Agency found that the vast majority of Iranian armed forces' interactions with the U.S. Naval presence in the Persian Gulf are professional, "however, Iran has increased maritime surveillance of U.S. forces in the Persian Gulf using unmanned aerial vehicles (UAVs), and the potential remains for additional unsafe and unprofessional interactions." Iranian drones have undertaken numerous risky encounters with U.S. naval ships and aircraft in recent years as part of a broader campaign of harassment of U.S. forces in the Gulf. For the most part, these incidents have been characterized by drones coming too close to naval assets while conducting surveillance.

There is a serious risk of these unsafe encounters escalating to further hostilities, as it can be challenging in real-time to assess the intentions of an adversarial UAV. Iran has invested heavily in arming its ISR drones and developing suicide mission capabilities, so every Iranian UAV that approaches the U.S. Navy in the Gulf represents a potential threat. Some recent drone encounters include:

In 2014, an unidentified Iranian drone [conducted an overflight](#) of the USS George H.W. Bush, according to the U.S. Navy.

In January 2016, Iran [flew a Shahed-121](#), an unarmed ISR variant from the same family as the Shahed-129 UCAV, over the USS Harry Truman in international waters 89 nautical miles southwest of Iranian territory. An internal naval report characterized the incident as "safe, abnormal and unprofessional" due to the rarity of such overflights. Iranian TV broadcast footage purported to be from the overflight showing the UAV hovering over the carrier and briefly passing a targeting bracket over a jet parked on the deck.

On August 8, 2017, an Iranian UAV [harassed and nearly collided](#) with a F/A-18E Super Hornet that was circling above the USS Nimitz attempting to land. The U.S. Navy initially identified the UAV as a QOM-1 and clarified that Iran refers to it as Sadegh-1. The Sadegh-1 is a [variant of the Mohajer-4B](#) capable of being retrofitted with MANPAD air-to-air missiles. The Iranian UAV involved was unarmed. The Sadegh-1 was observed loitering several miles away and ignored repeated radio calls warning the drone operator to stay clear as it approached. The U.S. pilot performed an evasive rollover maneuver to avoid collision, and the aircraft passed within 100 feet of one another. In a statement, the Navy [deemed](#) the encounter "unsafe and unprofessional."

Days later, on the evening of August 14, 2017, another Iranian Sadegh-1 UAV made [several passes around the USS Nimitz](#), coming within 1000 feet of the aircraft carrier as it was carrying out operations with jets on its flight deck. The Navy again characterized the encounter as unsafe and unprofessional. A Navy spokesman issued a statement that "The failure of the Iranian UAV to utilize standard, internationally-mandated navigation lights during a nighttime approach of a U.S. aircraft carrier engaged in flight operations created a dangerous situation with the potential for collision, and is not in keeping with international maritime customs and laws."

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In June 2019, amid simmering tensions with Iran following the U.S. designation of the IRGC as a terrorist organization, Iran [shot down](#) with a surface-to-air missile, a \$130 million surveillance drone that it asserted violated the airspace over what it claims to be its territorial waters, a charge the U.S. disputed. The U.S. was set to strike military targets within Iran in retaliation but pulled back minutes beforehand over concerns about civilian loss of life. Iranian Foreign Minister Javad Zarif [said](#) of the incident, “We came a few minutes away from a war.”

The incident underscored the challenges facing U.S. military decision makers when it comes to the drone warfare arena. In going after such an expensive and sophisticated military asset, Iran surely baked in the likelihood that the U.S. would respond and yet still decided to act. Ultimately, the U.S. must find a balance that enables it to deter further aggression without provoking further escalation, while also weighing the value of civilian lives against the cost of military assets. While the decision to pull back prevented the outbreak of further hostilities, by not retaliating in this instance, the U.S. also likely undercut its deterrence and sent an encouraging signal to Tehran that further provocations would not be met with a response.

In July 2019, having faced no consequences following previous instances of naval harassment and after the downing of the U.S. drone, Iran again utilized its UAVs in an antagonistic manner. An Iranian drone [came within 1000 yards of the USS Boxer](#), an amphibious assault craft, as it transited the Strait of Hormuz. It has not been confirmed whether the drone was armed or not. After not targeting Iranian drones in previous incidents, as they happened over international waters, this time, the U.S. responded by downing the Iranian drone. It should be noted that the downing of the rudimentary Iranian drone was in no way a commensurate reprisal for Iran’s previous downing of an advanced U.S. drone, but it did signal a potentially updated approach to how the U.S. would respond to Iranian drone harassment going forward.

Military.com [reported](#) that the U.S. used an anti-drone system called the Marine Corps’ Light Marine Air Defense Integrated System (LMADIS) to jam the drone’s communications, causing it to crash in the water. It was the first known instance of the U.S. using low-cost energy weapons it has spent years investing in to counter low-end threats such as Iranian drones, a promising development as the alternatives typically require expensive air defense missiles.

For its part, Iran denied having lost a drone. State media [released surveillance footage](#) it claimed to have recovered from the drone in question, which it identified as a Mohajer-4, of the USS Boxer. If the U.S. account is true, then it reinforced to Iran that it may now incur a cost going forward for unsafe maritime drone approaches. From a technological standpoint, the U.S. may have taken a big step forward in neutralizing Iran’s ability to harass naval vessels with drones. However, it remains to be seen whether the U.S.’s new electronic weapons would be effective against a drone swarm.

In April 2021, the IRGC [released](#) drone footage of a reported overflight of a U.S. aircraft carrier in the Persian Gulf. It was unclear when the overflight took place and what sort of drone was used. Iranian state media boasted that the “strikingly precise and close footage of an American aircraft carrier

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captured by the elite force's drones" were evidence of Iran's "state-of-the-art advancements in the field of drone technology."

Iranian Drone Use in Iraq and Syria

Iran has used the conflicts in Iraq and Syria to cultivate military, political, diplomatic, economic, and cultural influence in these countries as part of its hegemonic efforts to export the Islamic Revolution. Iran has sought to entrench a military presence in both countries to give it further bases of operations, away from the Iranian homeland, for it to confront Israel and U.S. and coalition forces. The conflicts in Syria and Iraq have provided Iran an ideal staging ground to test the UCAV advances it has made over the past decade. Iran has used drones in these conflicts for surveillance and attacks as part of its efforts to preserve the Assad regime, to confront ISIS, and to establish military influence and an entrenched military presence.

Iraq: Iranian drone activity in Iraq has been occurring for years. For instance, in 2000, Iraq [announced](#) its air defenses shot down an Iranian drone near the Iran-Iraq border. Another incident occurred in February 2009 when an Ababil-3 [crossed](#) from Iran into Iraqi airspace and penetrated 10 km. before being shot down by U.S. forces. Under the status of forces agreement in place between the Iraqi government and the U.S. at the time, the U.S. was fully responsible for defending Iraq's airspace. Iraqi officials claimed the incident was probably inadvertent, but the U.S. alleged that it was likely an instance of Iranian interference in Iraq, [citing](#) the fact that the drone remained in Iraqi airspace for over an hour before the U.S. engaged it. At the time, the Ababil-3 had not yet been armed, so the drone was almost certainly on an ISR rather than attack mission. Iran may have been seeking to spy on the U.S. military presence in Iraq, scouting out weapons smuggling routes, or conducting surveillance on Iranian dissidents at Camp Ashraf, a former refuge for the Mujahedin e-Khalq organization which was in the vicinity of the engagement.

The rise of ISIS in Iraq in 2014 paved the way for Iran to establish consistent drone operations in Iraq and to provide UAVs to some of the Iraqi Shia militias it backed. Iran's drones served an important psychological dimension, showing that Iran had sophisticated military technology at its disposal and was willing and able to use it freely to back its allies in Iraq. Iran's drones thus enhanced its prestige in Iraq, serving to bolster its political and military influence.

The rapid fall of Mosul with little resistance from Iraqi government forces in June 2014 created an opening for Iran to take on a more active military role in Iraq. Former IRGC-Quds Force Commander Qassem Soleimani, acting in conjunction with the Iraqi government, helped stand up the Popular Mobilization Forces (PMF), an umbrella organization of predominantly Shia militia groups – many backed by or fully subservient to Iran – that coordinated with Iraq's central government in the fight against ISIS.

The rise of ISIS created a brief de facto tactical alliance of convenience between the U.S. and Iran against the shared foe. Soleimani exploited the state of affairs to [ramp up exports of military hardware](#) to Iran-backed forces, flying two transport planes a day to Baghdad each carrying 70 tons of equipment. Iran was also able to take steps toward entrenching a military presence in Iraq, setting up a special control

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center at Baghdad's Rasheed air base, which had previously been in American hands. The IRGC also dispatched a contingent to Iraqi Kurdistan to assist Kurdish peshmerga forces in their fight against ISIS, mainly in an advisory capacity. The Obama administration viewed Iran's machinations in Iraq warily, but was ultimately permissive of them.

At the Rasheed air base, Iran set up a signals intelligence unit to monitor ISIS's electronic communications and began directing drone surveillance operations to monitor ISIS's physical presence on the ground. Initially, the New York Times [reported](#) that Iran was operating Ababil ISR UAVs, most likely the Ababil-3, for its drone surveillance. Based on several instances of [downings](#) of Iranian drones over ISIS-held territory, it appears that Iran began using Mohajer-4 ISR drones for surveillance missions as well. Iran is often deliberately opaque when it comes to revealing the extent of its combat involvement in Iraq and Syria, and the IRGC has in the past claimed to be present only in an advisory role. The drone downing incidents offer some of the most concrete evidence of Iran's frequent drone operations in Iraq and Syria. They also highlight the communications issues Iran has had with maintaining contact with its drones in combat settings beyond short ranges, a situation exacerbated by Iran's lack of access to satellite networks.

In July 2014, a Mohajer-4 drone allegedly [crashed](#) and was recovered by ISIS near Samarra north of Baghdad. ISIS photos of the incident depicted the downed UAV, which was indisputably Iranian in origin, carrying several Iraqi flag decals, which raised questions over who owned and operated the drone. Analysts theorized the decals could have been [photoshopped](#) by ISIS, could have been placed on by Iran to [obfuscate](#) the extent of their involvement in Iraq, or less plausibly, that Iran may have supplied UAVs to the Iraqi government, who had previously [sought to acquire such technology from the U.S.](#)

In November 2014, [pictures emerged](#) of a downed Mohajer-4 in the town of Jalawla, Diyala Province and another in the Hamrin Mountains, where the IRGC and ISIS had been clashing. Qassem Soleimani was [reportedly](#) in Diyala Province at the time, which is on Iraq's eastern border, coordinating the battlefield activities of Kurdish peshmerga and Shi'a militia forces along with Hadi al-Amiri, commander of the Iran-backed Badr Brigade. Shortly thereafter, the Soleimani-led forces reclaimed Jalawla and the neighboring town of Saadiya. In mid-December, photos [emerged](#) showing that Kurdish peshmerga had taken back custody from ISIS of the Mohajer that crashed in Jalawla the previous month. Another Mohajer-4 [crashed](#) in Kirkuk and was displayed by ISIS in January 2015. Analysts were able to tell it was a Mohajer-4 based on the prefix of the serial number on the downed UAV.

In February 2015, ISIS showed pictures of a [crashed Ababil-3](#) it recovered which it claimed to have shot down near Samarra. Similar to the Mohajer-4 that previously crashed near Samarra, the downed Ababil-3 was also purported to have Iraqi flag decals affixed. The incident marked the first confirmation that Iranian-origin Ababil-3s were indeed present and operational in Iraq.

Reports of Iranian drone operations in Iraq subsided after the pacification of the ISIS threat. However, in September 2018 and July 2019, Iraq was the staging ground for significant integrated drone and missile attacks launched from Iranian territory targeting an Iranian Kurdish dissident movement headquartered in Iraqi Kurdistan.

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In September 2018, Iran [fired a salvo](#) of seven short-range Fateh-110 ballistic missiles at the Iraqi Kurdistan base of an Iranian Kurdish separatist movement, killing at least 11. The IRGC used unidentified drones to film the attack and assess the damage. According to the IRGC Ground Force's Drone Division commander, Akbar Karimloo, drone surveillance also played an integral role in target acquisition for the missile attack. Karimloo told [Tasnim](#), "The only documents we had in the operation against the KDP were via UAVs. That is, the field commanders who commanded the missile operation guided the operation using the drone. More importantly, we did combat work and dropped bombs and hit pre-determined targets... In that operation, we were able to show the world the power of missile operations using UAVs, and it was this special power of UAVs that was seen."

The Iranian drone and missile attacks were followed by sporadic clashes between the IRGC and Kurdish militants. The situation came to a head in July 2019, when the IRGC carried out an operation in [retaliation](#) for an ambush on an IRGC military vehicle suspected by Iran to have been carried out by Kurdish militants that killed three Revolutionary Guardsmen in Iran's West Azerbaijan province several days prior. The IRGC Ground Force, including the [Drone Division](#), carried out the attack on "active headquarters, shelter, and training" locations of "anti-revolutionary" Kurdish militants on the Iraqi side of the border, according to [Tasnim](#). In a statement, the IRGC [claimed](#) to have killed or wounded a large number of Kurdish militants in its operation.

The Iranian reprisal was [reported](#) to consist of artillery, missile, and UAV attacks. According to [Tasnim](#), the IRGC used [Mohajer-6 ISTAR UCAVs equipped with Qa'em precision-guided missiles](#) in its attacks. Iranian media released a [video](#) purporting to show highlights of the Iranian operation which displayed a Mohajer-6 in flight and air-to-surface missiles hitting targets. According to IRGC Drone Force Commander Akbar Karimloo, the Mohajer-6 was used for both target acquisition for the missiles used in the attack, and the drones themselves [conducted strikes](#) using their own cargoes.

Syria: Iranian support for the Assad regime in the Syrian Civil War, which began in 2011, was [initially](#) limited to advising and training Assad regime forces. Iranian support to the Syrian regime increased markedly in 2012 as Assad risked losing power due to rebel advances and force attrition. Iran began sending [hundreds](#) of IRGC fighters to Damascus, stanching and eventually reversing Assad's losses. Iran also began injecting vast quantities of [military equipment](#) into the conflict, despite being subject at the time to two separate U.N. arms embargoes, [UNSCR 1737](#) and [UNSCR 1747](#), that prohibited states from supplying or taking delivery of Iranian arms and weapon systems, including UAVs. Iranian UAVs have played an important role in helping the Assad regime to stay in power, providing support in the form of surveillance, targeting, and eventually, air strikes to augment Syria's conventional air power, which has suffered significant attrition during the conflict.

As Iranian arms increasingly flooded Syria in spite of the export ban, Iranian UAVs became a frequent presence in the skies starting in February 2012. It is usually not fully clear whether the [Syrian government, Hezbollah forces, or the IRGC itself](#) are operating the UAVs, but at the least, Iranian supervision of its drones' flights can typically be assumed. Until 2015, the Iranian drones exclusively carried out ISR and targeting missions, helping pro-Syrian government forces monitor rebel positions and relaying intel that would then be used for artillery strikes. Syrian rebels came to know that if they

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spotted a drone, rocket attacks were usually imminent. As of late 2015, Iranian drones have been used for attack functions as well.

The first reported Iranian drone sightings by anti-government forces occurred in February 2012. That month, an unidentified observer [filmed](#) a UAV, later identified as a Mohajer-4, flying over the rebel-held city of Kafr Batna, a suburb on the eastern outskirts of Damascus. Later that month, rebels [observed](#) an Ababil-3 light tactical ISR drone over Homs. In one infamous incident, Iranian-made drones were used to [target](#) a makeshift media center used by Syrian opposition activists in Homs. An American journalist, Marie Colvin, and a French photojournalist, Remi Ochlik, were killed by rocket fire that hit the media center. According to a photographer embedded with Colvin, a veteran who served in British Royal Artillery for six years and who was himself injured in the attack, on the morning of February 22, 2012, pro-Syrian forces began shelling the area around the media center. Within an hour, the photographer heard a targeting drone overhead. Once the drone appeared, Katyusha rocket fire began closing in on the media center, culminating in four direct hits. According to the photographer, the pro-Syrian forces used a bracketing technique, assisted by the targeting drone, to zero in on the media center. The photographer further noted he witnessed drones hovering over Homs 95% of the daylight hours during the fortnight he was embedded there.

Drone overflights by Mohajer-4s and Ababil-3s became increasingly routine – UAV expert Galen Wright accounted for [over 50 Ababil-3 sightings](#) between February 2012 – January 2014, including several crashes. The drone sightings were primarily concentrated in the suburbs around Damascus, which were hotbeds of insurgent activity. The Ababil-3 was particularly suited for Syria's urban combat zones, as it is capable of being launched from a simple metal stand perched on a truck or the ground.

In November 2013, pro-Assad forces [began](#) using [Yasir UAVs](#) for surveillance and targeting as well. Syria's al-Qaeda affiliate, Jabhat al-Nusra, [claimed](#) to have shot down a Yasir in December 2013 over Aleppo.

In April 2014, Free Syrian Army forces [observed](#) a drone that appeared to be a Shahed-129 flying over the Damascus suburb of East Ghouta. The drone was unarmed, which means it may have been a Shahed-123, a smaller unarmed variant of the Shahed-129 medium-altitude long-endurance (MALE) combat, intelligence, surveillance, and reconnaissance (CISR) UCAV. Turkey [shot down](#) a Shahed-123 in a May 2015 border incident, claiming the drone crossed into its airspace, affirming that pro-Assad forces have used the Shahed-123 during the civil war.

As noted above, Iran has struggled, due to procurement and research and development issues, to fulfill the Shahed-129's potential as a combat drone capable of carrying out air-to-ground strikes. But in February 2016, Iran [released footage](#) purported to be, and later confirmed, of a Shahed-129 precision-striking rebel targets in Aleppo, confirming the drone's presence in Syria. Iran's use of Shahed-129s in Syria has been limited by the fact that the UCAV requires a runway for takeoff and landing, and it is believed that Iran operated its Shahed-129s in Syria from the [Hama](#) air base and [T4](#) air base in Homs governorate. In the broadcast footage, the Shahed-129 was [shown](#) providing air support to IRGC-backed militias fighting on the ground by dropping Sadid missiles on a group of rebel fighters and hitting a building in the village of Hasalah. The strikes, believed to have been carried out in October 2015, were

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the first known wartime drone strikes undertaken by Iran. Iran thus joined an elite group of nations with demonstrated capability of utilizing attack drones.

As operations in Syria increasingly shifted toward the battle against ISIS, Iran would use its Shahed-129s on two known occasions in June 2017 to menace U.S. forces conducting counter-ISIS operations from the al-Tanf airbase. Although the U.S. and coalition fighters had a shared foe with Iran and pro-Assad forces, the U.S. presence at al-Tanf was a source of friction, as it constrained Iran-backed militias' arms smuggling efforts in the vicinity as part of Iran's efforts to establish a land bridge from Iran to the Mediterranean. The U.S. declared a deconfliction buffer zone around the base to prevent hostilities from occurring between Iran-backed and pro-Assad forces and the U.S.-led coalition.

On June 8, 2017, a Shahed-129 [dropped a single munition](#) on U.S.-led coalition-backed Syrian fighters conducting counter-ISIS operations outside the deconfliction zone. The fighters were accompanied by coalition advisors at the time. The drone strike, which marked the [first time](#) U.S. forces had come under aerial attack since the Vietnam War, missed its target and "hit dirt," according to a U.S. spokesman for the coalition. The drone was [reportedly](#) still armed when an F-15E Strike Eagle fighter jet shot it down. The incident occurred a day after Hezbollah's Al-Manar TV [broadcast](#) footage of a Shahed-129 chasing a U.S. Predator drone it had in its sights in the skies over Al-Tanf, with a narrator warning, "we could shoot you down anytime, but we take pity on you." The threat was an empty one, as the Shahed-129 does not have air-to-air missile capabilities.

Twelve days later, an F15-E struck down yet another Shahed-129 that advanced on coalition-backed Syrian fighters accompanied by U.S. advisors at an outpost outside Al-Tanf. According to a Pentagon spokesman, the UCAV was [armed with ordnance](#), but was intercepted by the U.S. fighter jet before it could conduct a strike. The June 2017 UAV confrontations threatened to draw the U.S. into wider hostilities with Iran-backed and pro-Assad forces, but the situation calmed down as the U.S. did not undertake any reprisals beyond downing the two drones and emphasized its mission was limited to counter-ISIS operations, although it would not hesitate to take appropriate actions to respond to hostilities against its forces.

In the latter years of the Syrian Civil War, Iran has focused heavily on entrenching itself militarily in Syria. Iran seeks to leverage Syria's proximity to Israel to use the country as a forward operating base from which it can constantly threaten and attack Israel. One prominent node for Iranian entrenchment is the T4 airbase, where Iran has sought to establish "[a large air force compound under its exclusive control](#)," according to Haaretz military correspondent Amos Harel. Iran shares the large base with Russian and Syrian forces, but operates independently of them, controlling T4's western and northern sides. The IRGC's drone division has [deployed](#) a unit to T4, where they reportedly oversee UAV surveillance and attack operations, and research and development activities. Many of Iran's drones operational in Syria are housed at the base.

In the early morning hours of February 10, 2018, Iran engaged in a rare direct confrontation with Israel, sending a Saeqeh drone – Iran's reverse-engineered version of the Lockheed Martin RQ-170 Sentinel – from the T4 airbase into Israeli airspace. The Saeqeh was [reportedly](#) launched by the IRGC unit deployed at T4. It flew for approximately 20 minutes, cut through Jordanian air space, and entered Israeli

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airspace, where it was intercepted within [90 seconds](#) by an Apache attack helicopter north of Beit She'an. Video footage of the interception can be seen [here](#). According to the Israeli Air Force Chief of Staff, Israel permitted the drone to encroach its airspace so the IAF could shoot it down. The incident marked the first known indication that Iranian Saeqehs were present in Syria, and was the first known usage of Saeqehs in a combat scenario.

Israel immediately retaliated for the incursion, scrambling F-16I and F-15I fighter jets for an attack on several Iranian targets in Syria, including the T4 airbase. Israeli airstrikes temporarily knocked the base out of commission, and were [reported](#) to have demolished T4's "control tower, the mobile control station for UAVs, several UAVs and a number of support buildings." The Israeli fighter jets came under significant Syrian anti-aircraft missile fire, leading to the downing of an F-16I. The successful downing was likely a result of [pilot error](#) as the plane remained at a high altitude to confirm target destruction after striking the T4 command trailer, allowing Syrian radar to track it. Even so, the Syrian missiles did not make a direct hit, and the pilots were able to eject when they crossed back into Israeli airspace, [seriously injuring one and lightly injuring the other](#). Israel responded in turn by launching precision air strikes against Syrian anti-aircraft batteries, [reportedly](#) taking out half of Syria's air defenses.

In April 2018, the IDF released a [report](#) of the incident, in which they claimed that "the UAV was identified and tracked by Israeli defense systems until its destruction, effectively eliminating any threat the Iranian aircraft posed while flying towards Israeli territory." The IDF alleged that the Saeqeh UCAV was "armed with explosives and was tasked to attack Israeli territory," which they concluded by "analyzing the flight path and an operational and intelligence-based investigation of the remains." Israel's intelligence capabilities and small land mass give it inherent advantages when it comes to counter-drone defense, but even with technological advances, Israel has not achieved hermetic air defense. Even unsuccessful drone incursions like the February 2018 incident allow Iran to probe for vulnerabilities in Israel's air defenses and provide intel which they can use to adapt and continue to find new ways to threaten Israel.

In October 2018, Iran launched a salvo of at least [six Zolfaghar and Qiam-1 ballistic missiles](#) at ISIS militants operating near the eastern Syrian city of Boukamal. Iran followed up the missile attack with bombing runs by [seven armed Saeqeh drones](#) dropping what appeared to be Sadid-345 miniature precision-guided missiles. Analysts believed at the time based on existing photos of the Saeqeh that it [did not have a sensor turret](#), which would negate the missiles' precision-guided capabilities. The Associated Press additionally [reported](#) that "State TV aired footage of a drone dropping what appeared to be an unguided munition." Iran released [video footage](#) purportedly of the attack which showed a Saeqeh UCAV dropping munitions from an internal bomb bay, which indicates it likely used Saeqeh-2s in the attack. The Saeqeh-2 was first publicly revealed in January 2019, which may have been behind the confusion. According to Jeremy Binnie of Jane's Defence Weekly, the Saeqeh-2 "[had a relatively small and seemingly non-retractable electro-optical system under its nose that might be capable of designating targets for laser-guided weapons](#)." It is, therefore, possible, although not certain, that the October 2018 drone strikes were in fact a precision attack.

Iran proclaimed the attacks to be retaliation for a September terrorist attack at an IRGC parade in Ahvaz province, which was claimed by ISIS. The integrated drone and missile attacks came within a month of

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the drone and missile attack referenced in the previous section on the headquarters of an Iranian Kurdish dissident movement in Iraq. The attack reportedly took place within [three miles](#) of U.S. counter-ISIS forces, according to a Pentagon official.

The missiles used were [launched](#) from Iranian territory near Kermanshah and crossed over Iraq before hitting their targets; it is unclear whether the drones were launched from the same site. Kermanshah is roughly 570 km. from Boukamal, which is outside the Saeqeh's [reported 450 km. range](#). Iran is heavily reliant on line-of-sight control links to communicate with its UAVs, which limits the range of its UAVs, especially over hilly terrain. It is possible, however, that Iran preprogrammed the attack coordinates which would extend the range of its UCAV, or that Iran launched the drones from a closer point within Syria or Iraq. Iran did not follow deconfliction protocol ahead of the attack, endangering civil and military air traffic over the Iraqi airspace that the missiles and possibly drones passed through.

Iran staged the attack largely for propaganda purposes. The proximity of the attack to U.S. forces was designed to send a message that Iran is capable of carrying out similar attacks against the U.S. as well. In Iran's conspiratorial state ideology, the U.S., Israel, and Saudi Arabia created and back ISIS. Iranian state television was present at the launch, and a reporter declared as the missiles were launched, "This is the roaring of missiles belonging to the Revolutionary Guard of the Islamic Revolution. In a few minutes, the world of arrogance — especially America, the (Israeli) Zionist regime and the Al Saud — will hear the sound of Iran's repeated blows." Iranian state television also aired footage showing that one of the missiles was emblazoned with the slogan, "Death to America, Death to Israel, Death to Al Saud," casting further light on who the missiles intended targeted audience was.

Iran [claimed](#) in October 2018 it has undertaken hundreds of sorties and drone strikes against ISIS militants in Syria, the majority of which are likely to have been carried out with Shahed-129s. According to IRGC Aerospace Force Commander Brig. Gen. Ali Hajizadeh, [Iran's UCAVs](#) "were used in eliminating tanks, personnel carriers, cars used for suicide attacks and 23-millimeter cannons. We significantly turned the tide of battle." The statement by Hajizadeh marked the first time Iran had acknowledged offensive operations in Syria.

In August 2019, Israeli aircraft preemptively struck IRGC-Quds Force and Iran-backed Shi'a militia targets near Damascus, claiming they were preparing to launch explosives-laden "[killer drones](#)" into Israel's north. The Syrian army claimed that it destroyed the majority of the missiles dropped before they could hit their targets, but an IDF spokesman claimed the impact of Israel's operation was "[significant](#)." According to the Associated Press, the drones in question were [loitering munitions](#), disposable drones meant to carry out suicide missions. Iran's reversion to more primitive drones to try and attack Israel may be indicative of lessons learned from the February 2018 drone incursion. For one, it eliminated the risk of losing costlier, more advanced UCAVs in the likely event of an Israeli interception. More rudimentary drones can be more effective at evading radar. Although such drones carry less ordinance and cannot cause comparable damage to a Saeqeh or Shahed-129, a successful attack would still have a demoralizing psychological impact.

Iran's record of malign drone conduct demonstrates that the Syrian theater has been integral to Iran's efforts to advance its UCAV program, and that UCAVs play a large role in Iran's efforts to bolster its

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military influence and entrench a permanent military presence in Syria. As Iran has entrenched, it has used Syria (and similarly, Iraq) as a weapons transshipment hub, establishing supply lines to provide drones, precision-bombs, and other advanced weaponry to Hezbollah and Iran-backed Shia militias. Its use of Syria as a staging ground for UCAV attacks against Israel and the U.S. illustrates the extent to which Iran has a free hand to operate in Syria, as Assad has allowed Iran to undertake such operations even though they put his own forces at risk. The Israeli shoot-down of an armed Saeqeh in February 2018 showed that Israeli intelligence has full situational awareness at all times of the Iranian drone threat emanating from Syria. Israel has shown on numerous occasions that it is willing to strike Iranian targets in Syria and Iraq to stanch the Iranian proliferation threat and rein in the arms supply network Iran is building in the region.

Iran's Provision of UCAVs to Proxies

The Iranian UCAV threat is compounded by Iran's record of providing UCAV technologies to its proxies, most notably Hezbollah, the Houthis, Hamas, and Iran-backed Iraqi Shi'a militias. Until recent years, military aircraft were limited to nations with the resources to develop, fly, and maintain fighter jets. With the advent of cheap modern drones, and drone bodies converted to weapons, non-state actors are now able to field aerial attack capabilities as well. UCAVs offer many advantages to non-state actors who lack the money and infrastructure to field a conventional air force; essentially, drones provide an instant air force for a fraction of the cost. Iran's proxies' UCAVs act as a force multiplier for Iran, sowing terror against Iran's adversaries in pursuit of Iranian foreign policy objectives while offering Tehran a degree of plausible deniability as to their culpability.

Iran has kept its most advanced technology, UCAVs with integrated attack capabilities requiring drone operators on the ground, largely to itself with the exception of Hezbollah. It has provided less sophisticated drones, most frequently the Ababil-T, to its proxies, as these drones are cheap, disposable, easy to assemble, easy to train militias on their use, and are preprogrammed for attacks by plugging in GPS coordinates, negating the need for trained ground operators. Further, they are slower-flying and give off less radar signature than more advanced drones, making them harder to detect and allowing their operators to slip through weaknesses in air defense systems. Iran's proxies have deployed drones to surveil and attack adversaries on numerous occasions already, and the threat to U.S. allies and interests continues to grow as advances in commercially available drone technology become more accessible, further leveling the playing field.

Hezbollah

As Iran's principal proxy, Tehran has been the primary source of funding, arming, and training Lebanese Hezbollah since the group's inception. While Hezbollah is the most heavily armed and technically capable sub-state actor in the world, its conventional capabilities still are no match for Israel. Hezbollah has thus relied heavily on psychological warfare designed to terrorize Israeli civilians as part of its military doctrine to bridge the gap. Most infamously, the Iran-backed terror group indiscriminately lobbed up to [160 Katyusha rockets per day](#) at Israeli population centers during the 2006 Israel-Hezbollah war. Today, the group reportedly has between [100,000 and 150,000 missiles and rockets](#), many more advanced and with longer ranges than the projectiles it utilized in 2006, and all of Israel is now within its

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range. Hezbollah has also been working to acquire GPS-enabled precision-guided missiles to improve the accuracy of its arsenal.

Drones are another element of Hezbollah's psychological warfare toolkit that have been employed by the group on numerous occasions since 2004 to terrorize Israel. Iran has willingly shared its drone technology with Hezbollah, as the group's south Lebanon stronghold gives it the advantage of geographical proximity to Israel and lends plausible deniability as to Iran's culpability. While its drones have not caused physical damage inside Israel, every incursion into Israeli airspace represents a propaganda victory for Hezbollah, allowing the group to claim it can challenge Israel's unrivaled air superiority. Hezbollah's drone infiltrations can also cause Israelis to lose faith in the government's ability to completely control the country's airspace and cast doubt on the efficacy of Israel's air defenses, which are tasked with defending against an array of rocket, missile, and drone threats posed by Hezbollah, Hamas, Palestinian Islamic Jihad, and ISIS in the Sinai. In recent years, Hezbollah has also increasingly used drones in the Syrian civil war for surveillance and attacks against opposition groups and ISIS, helping the group to continuously improve and refine its drone capabilities.

Hezbollah's first recorded drone use occurred in November 2004 when it dispatched a [small reconnaissance UAV](#) that flew from southern Lebanon along Israel's Mediterranean coast to Nahariya, a coastal city 9.6 km. from the Lebanese border. The drone then hovered above Nahariya at a low altitude for about twenty minutes before returning to Lebanon overflying the Mediterranean Sea. The drone crashed in the sea where it was retrieved by Lebanese fishermen and [handed over to Hezbollah operatives](#). The drone incursion was the first recorded instance of a non-state actor using UAVs against a state power and set a precedent for Hezbollah's emergence as the UAV leader among sub-state armed groups.

The UAV type Hezbollah used in its drone incursion was referred to by Hezbollah as a Mirsad-1. Hezbollah Secretary-General Hassan Nasrallah [denied](#) Iranian assistance despite evidence to the contrary, likely in a bid to shield his Iranian patron from added international and Israeli pressure. The Arabic name Hezbollah gave the drone belied its Iranian origins. Some analysts believe the Mirsad-1 was actually an Iranian [Mohajer-4](#) while others believe it is the [Ababil-T](#), the twin tailed variant of the Ababil-2. Based on claims by Nasrallah that the drone could be armed with 40-50 kg. of explosives, it is more likely the Mirsad-1 than the Ababil-T, aUCAV that has also been frequently used by the Houthis in Yemen for kamikaze-style attacks.

U.S. and Israeli intelligence [alleged](#) that Iran provided Hezbollah with its UAVs, most likely disassembling them, flying them in cargo planes loaded with weaponry over Iraqi airspace to Syria, where they would be trucked to Lebanon and reassembled by Hezbollah operatives. According to contemporaneous [reporting](#), a senior IRGC member confirmed that Iran had supplied eight UAVs to Hezbollah in August 2003 and that the IRGC trained members of Hezbollah's "technology warfare" unit in operating the drones. Haaretz further reported that Iranian military personnel were present at a Hezbollah command center during the Mirsad's inaugural flight, and that around 30 Hezbollah operatives had received training in drone operation at an IRGC drone base near Isfahan.

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The drone incursion represented a propaganda victory for Hezbollah, which [broadcast](#) a 20-second clip of the twin-tailed UAV on its TV station, Al-Manar. Based on Hezbollah's statements surrounding the Mirsad-1 flight, it is clear that the group's intentions were to humiliate and strike fear in Israel while holding themselves up as capable defenders of Lebanese sovereignty against Israeli aggression. This stance is ironic given that Hezbollah is a militia subservient to Iran whose ongoing refusal to disarm undermines the Lebanese government's monopoly on the use of force and has plunged the country into conflict on several occasions.

Regardless, Hezbollah framed the Mirsad-1 flight as an appropriate act of resistance to Israel's frequent overflights of Lebanese territory, [stating](#), "This qualitative and new achievement by the Islamic Resistance in Lebanon comes as part of a natural response to the Zionist enemy's repeated and permanent violations of Lebanese airspace." The Lebanese government [backed](#) Hezbollah's operation as no other steps, including appeals to the U.N., had curtailed Israel's incursions. The U.N. [responded](#) by condemning both the Hezbollah drone flight and Israeli violations of Lebanese airspace.

Following the incursion, Hezbollah [warned](#), "Starting today, we will send our planes as we please." The groups' commander in southern Lebanon [proclaimed](#), "The Israelis are living in a state of shock." At a rally shortly after the operation, Nasrallah [boasted](#), "You can load the Mirsad plane with a quantity of explosive ranging from 40 to 50 kilos and send it to its target. Do you want a power plant, water plant, military base? Anything!"

Hezbollah followed up the November 2004 Mirsad-1 incursion with a repeat reconnaissance mission into Israeli territory in April 2005. In the second flight, a Mirsad-1 eluded Israeli radar and flew over Israeli towns in the Western Galilee [unmolested for nine minutes](#) before returning safely back to Lebanon. The UAV, equipped with cameras, was able to deliver footage of its journey taken inside Israel back to Hezbollah. The IDF [reportedly](#) scrambled jets in response but failed to intercept the UAV. While the military utility of Hezbollah's early drone forays was negligible, surveillance footage from drone overflights presumably would be able to help Hezbollah enhance its targeting capabilities in future conflicts with Israel, enhancing the accuracy and lethality of its rocket arsenal.

The two Mirsad-1 incursions caught Israeli intelligence by surprise and served to highlight a [flaw](#) in Israel's air defenses at the time. Although Israel had expensive, elaborate, and overlapping air defense systems, its focus was oriented toward detecting high-flying, fast-moving fighter jets and projectiles. Hezbollah's slow, low-altitude drones had less radar signature than the threats Israel's air defenses were designed to monitor against, and were effectively able to slip through undetected due to ground clutter, glare, and environmental conditions.

During the 2006 conflict between Israel and Hezbollah, Hezbollah attempted at least three drone incursions into Israel with Mirsad-1s, and at least one of the drones was [reported](#) to be armed with explosives and metal shrapnel in order to create carnage on the ground. Prior to the war, Israel assessed that Hezbollah had received at least 12 Mirsad-1s from Iran. Beyond delivering its Hezbollah client UAVs, Israeli intelligence officials [asserted](#) that approximately 100 Iranian advisers worked with Hezbollah during the conflict and "created a Hezbollah command center for targeting and controlling missile fire

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with advanced command and control assets and links to UAVs.” Israel successfully tracked and intercepted all three drones, indicating it had rapidly improved upon its air defense capabilities.

On the evening of August 7, 2006 Israeli Air Force air defense radars [detected](#) a Hezbollah Mirsad-1 immediately after it was launched from southern Lebanon. The drone crossed the international border and headed south along the Mediterranean coast toward central Israel. When the drone reached the city of Acre along the Bay of Haifa, an IAF Lockheed Martin F-16C [engaged](#) it 10 km. offshore, shooting it down with a Rafael Python 5 air-to-air missile, the first known operational kill for the missile. Based on wreckage of the UAV salvaged by Israel, it was not found to be armed with explosives, although it plausibly may have been. One of the UAV’s tails was emblazoned with a Hezbollah decal with the English words “Islamic Resistance” on the insignia. The night time flight indicated that Hezbollah had upgraded the UAV with infrared sensor capabilities.

A week after that incident, Hezbollah launched two more Mirsad-1s that were again intercepted by Israel. One of the UAVs was [downed](#) over Lebanon and crashed near the city of Tyre. The other infiltrated into Israel and was shot down over Kibbutz Cabri in the Western Galilee. Some 30 kg. of explosives and metal shrapnel were discovered in the wreckage of the UAV downed in Israel, indicating Hezbollah’s intention to use it for a kamikaze attack.

After the 2006 war, reported Hezbollah drone activity abruptly stopped but during the intervening period, Iran continued evolving its UCAV capabilities. On October 6, 2012, the anniversary of the surprise attacks that heralded the start of the 1973 Yom Kippur War, Hezbollah launched its most daring drone incursion to date, penetrating deeper into Israel than ever before and transmitting images of sensitive military sites. The relative sophistication of the October 2012 incident compared with the previous drone incursions underscored that Iran was sharing its technological advances with Hezbollah and that the group’s capabilities in the UAV sector have grown in tandem with Tehran’s.

On October 6, 2012, Hezbollah militants, [reportedly](#) acting subordinate to IRGC technicians on the ground in southern Lebanon, launched an unarmed surveillance drone that flew over the Mediterranean as far south as the Gaza Strip before swooping inland, overflying Gaza, and crossing into Israeli territory. Based on the UAVs flight path, it was believed to be heading for the [Dimona nuclear facility](#), one of the most sensitive and protected sites in Israel reputed to be home to its undeclared nuclear weapons arsenal. In all, the drone penetrated 140 miles into Israel from the Lebanese border, flying for [35 miles](#) over Israeli airspace before an IAF F-16 shot it down 20 miles from the Dimona nuclear facility. It was unclear whether the drone was operated using a pre-set flight plan or piloted remotely, which would mark an upgrade in the capabilities of Iranian drone technology.

The drone’s incursion was widely perceived as a security debacle for Israel and a propaganda boon for Hezbollah and its Iranian patron, which naturally sought to exaggerate the military significance of the incident. Further adding to Israel’s black eye, its first attempt to intercept the UAV using a Python IV air-to-air missile fired from an F-16 missed its target. According to the military aviation blog [The Aviationist](#), “the Python is considered as one of the most advanced missiles in the world, with superior performance and maneuverability.” The failure to hit a slow-moving target that Israel had been tracking for minutes represented a first of its kind misfire for Israel.

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Hezbollah [claimed](#) to have transmitted images of Israel's preparations for a joint military drill with the U.S., ballistic missile sites, airfields, and even of the Dimona nuclear facility, although this claim was [dubious](#). According to an Iranian lawmaker, the drone "[transmitted](#)" pictures of "forbidden sites" that were now in Iranian possession. Hezbollah claimed on Al-Manar, which broadcast an animated simulation of the drone flight, that the drone flew [320 km. \(200 miles\)](#) in total and went undetected by Israeli radar over the Mediterranean and Gaza.

Israeli military officials disputed many of Hezbollah and Iran's boasts. The IAF reportedly [tracked](#) the drone along its route over the sea before shooting it down within Israel when it flew over an unpopulated area, casting doubt upon Hezbollah's [claims](#) to have evaded Israeli radar and air defense systems. However, the truth of the matter is murky, as another anonymous Israeli defense source admitted that Israel struggled to detect the drone due to "[unfamiliar stealth elements](#)." While Iran and Hezbollah claimed the drone transmitted photos of sensitive military sites and preparations, in actuality they likely did not glean any intelligence of value from the drone flight. According to the former [head of Israel's military drone unit](#), "As far as I understand, this drone could not have collected intelligence that could not be obtained through Google Earth or other methods that are simpler and more easily accessible." Israel assessed that the drone was technologically [primitive](#) and not actually capable of transmitting real-time imagery during its flight, as it would have to relay the data through a satellite, a capability it is not believed to possess.

Regardless, the psychological value of the drone incursion for Hezbollah and Iran was more significant than the intelligence value of the operation, or the cost of the lost drone. Iran had proved that it could plausibly imperil the Dimona nuclear reactor, to say nothing of other critical infrastructure throughout the country, with UAVs should Israel launch an attack against Iran's nuclear program, compounding the threat posed by Hezbollah's missile arsenal. The incursion also proved that Iran's drone program had made a technological breakthrough, flying for a longer distance than previously demonstrated. The distance the UAV flew on its mission, [over 300 km.](#), was enough to classify the drone as a Medium Altitude Long Endurance (MALE) UAV.

Hezbollah referred to the drone it used in the operation as the Ayoub, saying it was [named](#) to honor both an Islamic prophet and one of the group's martyrs, Hussein Ayoub. Hezbollah's October 2012 drone incursion came one month after Iran publicly unveiled the Shahed-129 for the first time. Analysts [concluded](#) that the Ayoub likely was the Shahed-129, the only drone Iran would have had at the time capable of such a long flight. While Iran claimed the Shahed-129 was capable of being armed from its inception, the drone used in the incursion was not armed. This fact does not preclude the possibility that the drone in use was a Shahed-129, as the first recorded instance of the Shahed-129 fulfilling its combat potential was not until October 2015 in Syria. In August 2018, a Hezbollah news outlet reported that Hezbollah maintains an open-air museum which displays its combat aircraft. One of the UAVs on display is [almost certainly a Shahed-129](#), indicating that Hezbollah did take possession of this platform. The fact that Iran shared its technology with Hezbollah so soon after developing the Shahed-129 revealed unprecedented levels of coordination between the IRGC and Hezbollah, and demonstrated Hezbollah's utility to Iran as an ally with geographical proximity to Israel willing to test out Tehran's newest military hardware in operational settings.

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Unlike past instances where Hezbollah sought to obfuscate Iran's role in arming and training the group, this time, Hezbollah and Iran openly boasted of the Ayoub's Iranian provenance. The Ayoub was "[manufactured in Iran but assembled by the resistance \[Hezbollah\]](#)," stated Hassan Nasrallah. This reflected shifting geopolitics of the time. With Iran under a robust international sanctions regime, it was more amenable to publicizing its role as Hezbollah's benefactor to show that it remained a powerful force capable of confronting its adversaries, alone or through its proxies.

A Lebanese newspaper reported at the time that the UAV was found to have components made in Germany – the camera and remote control parts were manufactured by Siemens while some light metal components were manufactured by Bockstiegel. Iran allegedly procured the drone technology through a fictitious IRGC front company, demonstrating Iran's ingenuity in circumventing sanctions.

Iran's Defense Minister Ahmed Vahidi bragged that Hezbollah's drone launch affirmed Iran's military capabilities, while IRGC Commander-in-Chief Mohammad Ali Jafari claimed the incursion into Israel had helped Iran gain "[strategic deterrence](#)." Nasrallah [warned](#) that the drone incursion was a precursor for future hostilities, stating, "Today we are uncovering a small part of our capabilities, and we shall keep many more hidden. ... (Hezbollah) can reach any place we want. ... [This is not the first time, and it will not be the last.](#)"

In April 2013, Israel [downed](#) another drone off the coast of Haifa that Hezbollah did not claim credit for, but was the only logical culprit. Israel successfully tracked the UAV as it overflew Lebanon, and downed it 8 km. offshore from Haifa over the Mediterranean. The motive behind the drone launch was unknown, although it may have been sent to conduct surveillance of Israeli offshore gas fields or chemical storage facilities around Haifa, or to probe the defenses of the IDF. Another possible motivation was that Hezbollah, which had escalated its involvement in Syria, wanted to signal that its top priority remained confronting Israel. Israel had in the months and weeks prior stepped up its practice of [reconnaissance flights](#) over Lebanon, claiming such flights were necessary to prevent Hezbollah from acquiring advanced weaponry in the chaos of the Syrian civil war. The April drone incident may have also been an effort by Hezbollah to respond in kind for Israel's frequent overflights of Lebanon.

Israeli media reported in 2013 that Hezbollah had around [200 Iranian-supplied drones](#) in its arsenal for both attack and surveillance purposes. Aside from the roughly half-dozen drone incursions into Israel since 2004, Hezbollah had little combat experience with UAVs. Hezbollah's participation in the Syrian civil war has changed that, however. The combat in Syria has had a transformative effect on Hezbollah, and the group has emerged today as a more battle-hardened, capable, and more lethally armed fighting force. This statement applies to the advances Hezbollah has made in its drone program in Syria as well.

As noted above, Iranian drones have been used extensively during the Syrian civil war, but it is not always clear whether their operators are the IRGC, Assad regime, or Hezbollah. Based on its close coordination with these actors, as well as Russia, which has also deployed drones in Syria, Hezbollah has in all likelihood played at least a contributing role in various pro-Assad forces' drone operations and worked alongside IRGC operatives at Iran's Syrian drone bases, learning lessons from more advanced

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actors in the UCAV space and thereby enhancing its own drone capabilities. This was confirmed by an anonymous Hezbollah operative, who told [Middle East Eye](#) in February 2017, “We are definitely learning a lot by working with Russians and Iranians in the Syria war and more specifically when it comes to UAVs.”

According to Nadav Pollak of the Washington Institute for Near East Policy, [Hezbollah’s drone experience in Syria](#) will ensure that the group’s UCAV operators are more technically proficient in operating the systems’ communications, optics, and weapons systems; that Hezbollah will be better able to coordinate UCAV operations with the activities of ground forces; and that it will be able to “use drones to improve their battlefield intelligence through better analysis and incorporating imagery intelligence with other sources (SIGINT/ELINT/OSINT).”

Hezbollah is known to have itself operated Iranian-supplied UCAV’s in Syria. IHS Jane’s reported in 2015 that Hezbollah had built a [secret airbase](#) likely intended for drone operations in Northern Lebanon ten miles west of the Syrian border. According to Jane’s, the airstrip, in mountainous terrain, possesses a 2200 foot unpaved runway that would be unusable by conventional aircraft, but suitable for drone takeoffs and landings. There is also an antenna at the site which could potentially be used to enhance the operable range of UAVs. Jane’s assessed that the mountain airbase was likely built with Iranian assistance between February 2013 and June 2014, indicating its purpose was to support Hezbollah and possibly Iranian drone operations in the Syrian conflict. Syrian battlegrounds such as Homs and Qusayr – which have seen frequent overflights of Iranian drones – are within range of the base even for short-range UAVs, like the Ababil-3. The base’s existence was a tangible demonstration of Iran and Hezbollah’s willingness to use Lebanese territory for its broader regional foreign policy objectives in Syria.

In September 2014, Hezbollah carried out its [first successful drone attack](#) against a base belonging to the Al-Qaeda-linked Jabhat al-Nusra near the northeastern Lebanese town of Aarsal. Al-Nusra had [expanded its operations into neighboring Lebanon](#) after Hezbollah joined the war in mid-2013, conducting and attempting suicide bombings against civilian centers like Beirut and Hezbollah strongholds like Hermel, along Lebanon’s northeastern border with Syria. Hezbollah’s drone attack against the group came immediately after Al-Nusra carried out a suicide bombing at a border checkpoint and executed a Lebanese soldier. Hezbollah reportedly killed 23 Al-Nusra combatants in the drone attack, which was conducted in the midst of a Hezbollah ground offensive against the group’s Lebanese bases.

It was unclear from media reports what drone platform Hezbollah used in the attack and whether the operation was a kamikaze-style strike, or involved a UCAV dropping air-to-ground munitions. Based on Iran and Hezbollah’s known capabilities at the time, it was more likely to have been a kamikaze style attack involving a disposable UAV, such as the Ababil-T, laden with explosives. However, Fars News reported at the time that, “Hezbollah drones for the first time bombed the headquarters of the terrorist al-Nusra Front at Lebanon’s border with Syria” indicating that Hezbollah may have preceded Iran in using UCAVs for airstrikes against Syrian rebels.

In May 2015, Hezbollah [reportedly](#) used drones in its battle against Jabhat al-Nusra near Qalamoun, releasing aerial [images](#) of enemy positions on Al-Manar. It was unclear at the time whether the unidentified drones used were strictly for reconnaissance, or were used in attacks as well.

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In August 2016, Hezbollah carried out a [drone attack](#) against rebel positions in Aleppo that had troubling implications for the future of drone warfare. Hezbollah released a video online purporting to show a commercially available quadcopter drone, which retails for only hundreds of dollars, dropping Chinese-made cluster bomblets on a rebel-held building. The commercially available drones are only capable of dropping small payloads, but the breakthroughs in commercial technology can give almost any non-state actor the ability to carry out small-scale drone attacks. The incident stoked fears that terrorist groups could someday use such drones to deliver a small [CRBN \[chemical, biological, radiological, nuclear\]](#) warhead.

In August 2017, Hezbollah media [reported](#) that Hezbollah was using drones against ISIS in Qalamoun that were capable of being armed with six medium-sized missiles. The drones on display appeared to be a smaller variant of the Shahed-129, likely with a shorter range as well that would make them useful for tactical strikes against enemy targets. Iran had likely delivered the small drone components to Syria, where Hezbollah technicians would put them together. A video on Al-Manar purported to show footage from one of the drones [dropping unguided bombs](#) on ISIS targets in the mountains. This incident confirmed that Hezbollah had now joined Iran in possessing drone strike capabilities.

In September 2017, the IDF [shot down](#) a Hezbollah reconnaissance drone with a Patriot missile that crossed into the demilitarized zone between the Israeli and Syrian border on the Golan Heights. The drone had taken off from Damascus International Airport and was identified and tracked by the IAF air defense control center, which made the decision to shoot it down as it crossed into the demilitarized zone. The IDF noted that Hezbollah had conducted frequent aerial surveillance of northern Israel from Syrian airspace, but on this instance came too close to the Israeli border. There was no specific intelligence threat indicating Hezbollah intended to infiltrate Israel, so the incident may have been attributable to user error.

In November 2020, the Israeli army [downed](#) a Hezbollah drone that crossed into Israeli territory, noting that the drone was monitored as soon as it entered Israeli territory and posed no threat to civilians or military sites in the North. In December 2020, Hezbollah [claimed](#) that it flew a drone into Israel during an October 2020 Israeli military drill that went undetected and safely returned to Lebanon. Hezbollah released aerial footage purported to be from the incursion showing two military installations near the Israeli-Lebanese border. Israel did not comment on Hezbollah's claims, but the incident would represent a propaganda coup for the group as the Israeli military exercise [reportedly](#) involved a simulated war with Hezbollah and one of the stated objectives was to prevent drone incursions from Lebanese territory.

In just over a decade, Hezbollah – with Iranian assistance – built a drone program from scratch and now has military-grade reconnaissance and attack UCAVs, as well as upgraded commercial drones. It has used its experience in the Syrian civil war to further hone and battle-test its drone capabilities, learning from Russia and Iran, and stands today as the leading non-state militia in the drone space. Hezbollah's investment in drones and improvements in capabilities forged in Syria will in all likelihood come into play during the group's next conflict with Israel. While Israel is a world leader in air defenses, and benefits from having a small geographical area to defend, it does not possess hermetic air defenses.

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Israel has shown it has the capability to defend against individual Hezbollah drones in sterile conditions, but it has not yet faced a coordinated barrage of Hezbollah missiles and drones launched simultaneously. Israel is likely to continue its policy of targeting advanced weapons transfers to Hezbollah to mitigate against the threat the group will play in the event of another war.

Hamas and Palestinian Islamic Jihad

In addition to the threat of Iranian-made drones Israel faces on its Syrian and Lebanese borders, it faces a less significant Iranian-made drone threat from Hamas in the Palestinian territories. Hamas's drone program has not advanced as much as Hezbollah's due to procurement issues, as the Gaza-based group faces a naval blockade and its land borders with Egypt and Israel are sealed. Still, the group has had an active drone program dating back to at least 2012, with Iran believed to be responsible for providing components and [Hezbollah and the Egyptian Muslim Brotherhood](#) reportedly also assisting Hamas in the development of its UAV program.

Hamas's relatively unsophisticated drones do not pose much of a tactical threat to Israel and have not significantly altered the balance of power between the two sides. Still, their occasional usage in operations inside Israeli airspace represents a show of strength for Hamas against a more powerful enemy with state of the art air defenses whose own combat aircraft and UAVs regularly patrol the Gaza skies. Hamas's drones are largely intended to boost domestic support and morale for the group, demonstrating that it is capable of "resistance" against Israel. Israel's Iron Dome anti-missile system has largely neutralized the threat posed by Hamas's rockets, so Hamas's pursuit of drone technology shows the group is resourcefully seeking other ways to infiltrate Israel and carry out attacks by air. Drones do not offer much of an advantage over rockets though in terms of operational success, as they are slow moving and typically destroyed by Israel before they can complete their mission.

In November 2012, Hamas's nascent drone program in Gaza was dealt a setback when the IAF [attacked](#) eight Hamas drone storage facilities and "inflicted severe damage to Hamas's UAV infrastructure." The IDF claimed it had been [monitoring Hamas's efforts to build a drone fleet](#) for the past several months before it struck. The IAF also released surveillance footage of what it purported to be a drone test flight in Khan Younis. In the video, the drone [spins out of control](#) before takeoff, but the IDF [alleged](#) that Hamas was close to fielding functional drones that would have placed Tel Aviv, about 70 km. north of Gaza, in range. According to UAV expert Galen Wright, the drone depicted appeared [physically similar to an Iranian Ababil-2](#) and Hamas appeared to have outfitted the model with a conventional landing gear for takeoff and recovery. Hamas reportedly was seeking drones for both reconnaissance and attack purposes.

In October 2013, Palestinian Authority (PA) security forces [reportedly](#) thwarted a Hamas terror cell near Hebron that was planning on launching explosives-laden UAVs into Israel. The cell was reported to be in the advanced planning stages of the foiled plot.

In July 2014, the Ezzeddin al-Qassam Brigades, Hamas's armed wing, claimed to have manufactured and flown [three different drone variants of a platform it called the Ababil-1](#), the A1A which was for reconnaissance missions, the A1B for attack and bomb-dropping missions, and the A1C for kamikaze

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missions. Based on the descriptions of the Hamas drones, the A1A is likely akin to the drone Iran calls Ababil-S, a surveillance variant of the Ababil-2. The A1C is likely akin to the Ababil-T, the twin-tail Ababil-2 variant capable of suicide missions. The backstory on the A1B is harder to deduce. Hamas released a video of an [A1B in flight](#) over the Gaza Strip, depicting what appears to be an Ababil-2 drone carrying four air-to-ground missiles mounted under its wings. According to military aviation blog The Aviationist, it is possible the missiles were [mock-ups](#), as they appeared similar to those displayed by Iran when it unveiled the Fotros prototype the year prior. The blog further noted that it would be unlikely a drone as small as the one displayed would be capable of carrying air-to-ground missiles, as such a significant payload would typically “require larger airframes, more robust wings and engineering capabilities not believed to be in Hamas possession until today.”

During Operation Protective Edge in July 2014, Hamas used drones in a combat operation against Israel for the first time. Hamas [claimed](#) to have undertaken three drone sorties over Israeli airspace on July 14. Each Hamas sortie reportedly consisted of two drones, and the group boasted one of the sorties hovered over the Tel Aviv IDF headquarters. Only one of the claimed sorties has actually been confirmed, and Israel denied knowledge of the alleged Tel Aviv drone infiltration. According to Hamas’s since-suspended Twitter account, the group used the [A1B attack variant](#). Hamas did not carry out any known drone strikes during the one confirmed and two unconfirmed missions, so its dubious claims that the A1B is capable of dropping bombs remained unverified. Further, Hamas admitted to [losing contact](#) with two of the “armed” drones it supposedly dispatched. The IDF [downed](#) the only confirmed drone over Ashdod, an Israeli coastal city roughly 50 km. north of the Gaza Strip, using a U.S.-supplied Patriot missile.

Three days later, Israel [shot down](#) another Hamas drone using a Patriot missile over the coastal city of Ashkelon. Hamas took credit for the drone and claimed it was dispatched to carry out an attack deep within Israel. Although its drone missions were unsuccessful, the fact that Hamas was able to infiltrate Israeli airspace on two occasions provided the group with a symbolic victory.

Following the war, Hamas stepped up its investment in UAV capabilities. In December 2014, a Hamas drone [overflew a Gaza military parade](#) meant to show the group’s armed strength to mark the 27th anniversary of its founding. Israel scrambled warplanes out of concern that the drone may have sought to infiltrate Israeli airspace, but returned the jets to their base when it became clear they did not pose a threat. During the parade, a Qassam Brigade spokesman thanked Iran for its role in arming Hamas, stating, “Thank you to all the people and the countries, first among which is the Islamic Republic of Iran which did not skimp on money, weapons and other things and provided the resistance with rockets.” It was reported at the time that Hamas had in recent weeks began using commercially-available quadcopter drones near the border with Israel, adding another dimension to the Hamas drone threat.

In September 2016, Hamas again tried to [infiltrate Israel with a drone](#). In this instance, the IAF tracked the drone from its launch and shot it down over Gaza with an air-to-air missile fired by an F-16 when it was seen approaching Israel. Israel had previously banned all air traffic over the Gaza Strip. Following the infiltration attempt, an IDF spokesman [remarked](#), “Hamas has been developing its drone capabilities, especially in the last two years. Today’s event proves once more that Hamas continues to

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invest in tools of terror and not in the needs of the people in Gaza.” A similar incident took place in [February 2017](#), with an Israeli F-16 again shooting down a Hamas drone before it could reach Israel.

Hamas’s drone program suffered a setback in December 2016 when Mohammad al-Zoari, a Tunisian-born aviation engineer and drone specialist described by the group as a pioneer of its UAV program, [was killed](#) in the Tunisian city of Sfax. Hamas claimed al-Zoari had been a member of its armed wing for 10 years and posthumously referred to him as a commander. Hamas claimed that al-Zoari, “the martyr of Palestine, martyr of the Arab and Muslim nation, the Qassam leader, engineer and pilot” was assassinated by “Zionist treacherous hands.” Al-Zoari was affiliated in his younger years with the Tunisian branch of the Muslim Brotherhood, of which Hamas is the Palestinian branch. After government crackdowns on Islamists, he left Tunisia for Damascus in 1991 where he cultivated ties with Hezbollah and Hamas. A Lebanese newspaper alleged that al-Zoari was also [influential in helping Hezbollah develop its drone program, while an associate of al-Zoari’s claimed that he served as a liaison for Hamas to the Iranian and Syrian governments](#) – the other major players in Iran’s “resistance axis.” While not well known until his death, Al-Zoari’s ties to both Hezbollah and Hamas show a concerted linked, Iranian effort to arm its proxies with UAV capabilities.

Tunisian newspapers blamed the Mossad for the assassination, claiming the Israeli intelligence organization had tracked him for some time. A truck boxed in Zoari in his driveway as he was preparing to leave his home at which point two killers emerged and shot him twenty times at point-blank range in his car. Following his death, [hackers accessed the surveillance camera of a nearby restaurant](#) and deleted security footage of the assassination, indicating a sophisticated operation. If the Mossad was responsible for the assassination on foreign soil, it would indicate that Israel takes the threat of Hamas’s drones very seriously.

According to Haaretz, in 2018, Hamas established a dedicated [air unit that operates UAVs](#), primarily for intelligence purposes. Another 2018 Haaretz [report](#) quoted an Israeli military official saying that Hamas was working on developing unsophisticated, commercially-available drones capable of being laden with explosives for suicide attacks. The report noted that in recent years, IDF soldiers in Gaza have witnessed an uptick in small, quadcopter style drones hovering above them.

Following these reports, Israel has faced a string of incidents involving unsophisticated armed drone infiltrations from Gaza. In May 2018, the IDF discovered an [explosives-laden drone](#) that had landed but not detonated in the northern Negev that was reportedly sent to injure soldiers patrolling the area. Ynet [reported](#) that this incident was one of three involving drones carrying explosives just in that month. In another of the instances, a drone dropped two explosive devices that landed on the front lawn of a residence in a border community, one of which detonated but failed to cause damage.

In May 2019, Palestinian Islamic Jihad, another Iranian-backed terrorist group headquartered in Gaza, released footage purporting to show a [drone controlled by its operators dropping small incendiary bombs on an IDF tank](#) stationed at the Gaza border. The tank did not appear to sustain damage, but the incident indicated that another Iran-backed force in Gaza has been experimenting with commercially-available drone technology and has gained rudimentary drone attack capabilities. It is unclear whether

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Iran had a direct hand in the terrorist group's efforts to smuggle in drones to Gaza and convert them to weapons.

According to a January 2020 Ynet [report](#), Hamas also used a weaponized drone against the IDF for the first time in May 2019. Hamas had apparently recovered a small, multi-rotor drone used by the IDF that fell in the Gaza Strip prior to the incident. Hamas engineers repaired the drone, took control of its systems, and upgraded it, attaching an explosive from a rocket-propelled grenade launcher to the drone. In May 2019, during the course of skirmishes with the IDF, Hamas launched the drone into Israeli territory, approached a military base, spotted an IDF tank, and dropped a grenade from a height of 100 meters. The grenade failed to detonate and the IDF subsequently shot down the drone.

In July 2019, the IDF [shot down](#) a drone that crossed into Israel from Gaza and headed toward towns near the border. In September 2019, a Hamas drone [dropped an explosive](#) that lightly damaged an Israeli military vehicle by the Gaza border fence. In October 2019, the IDF [downed](#) yet another drone that crossed into Israel from Gaza.

In May 2020, the IDF [warned](#) Hamas to stop cross-border drone flights into Israel from Gaza. The warning came in response to several alleged recent drone flights, believed to be conducted by Palestinian Islamic Jihad. As the ruling authority in Gaza, Israel holds Hamas responsible for all attacks emanating from the territory.

Taken together, the uptick in drone incursions, some armed, shows that armed groups in Gaza remain determined to attack Israel, whose air defenses and anti-tunnel technology have neutralized much of their capabilities to inflict harm. Continued incursions and subsequent Israeli reprisals increase the risk of future conflict with Israel. Drones, especially commercially-available models, are relatively easy for Hamas to smuggle, as they are small and whole drones or their components can be concealed in shipments of toys to Gaza, or in the luggage of people entering the Strip. According to [data from the Overland Crossings Authority at the Defense Ministry](#), Israel has seized hundreds of full drones or drone parts at the border crossings it controls. No similar data exists for Egypt's border crossing. In all likelihood, many drones and drone parts slip in undetected, where they make their way to Hamas workshops to be reassembled and possibly outfitted for military purposes.

In recent years, Hamas and Hezbollah have put aside differences over the Syrian civil war and [increased their cooperation](#). In the event of future hostilities between Israel and one of these parties, it is likely the other will join the fray, and that other Iranian proxy militias may get involved as well. On their own, Hamas's drone capabilities do not significantly threaten Israel. But in a wider conflict, Israel may face the prospect of combined drone and rocket attacks on multiple fronts from both Hamas and Hezbollah. Suicide drones could potentially be marshalled to take out air defense batteries, as the Yemeni Houthis have demonstrated in attacks on Saudi Arabia. While Israel retains a qualitative military edge over its adversaries, Hamas and Hezbollah's missiles and drones used in coordination could possibly inflict significant damage within Israel, and at the least would force Israel to spend exorbitantly to mitigate the threat. Drone interceptions involving scrambling fighter jets or surface-to-air missiles are highly costly, especially relative to the cost of Israel's adversaries' drones. For that reason, Israel is pursuing more

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cost-effective counter-drone technologies involving [radio jammers, lasers, and even high-pressure water guns](#).

Iraqi Shi'a Militias

The rapid fall of Mosul and rise of ISIS in Iraq in 2014 paved the way for Iran to provide UAVs to some of the Iraqi Shia militias it backed in the Popular Mobilization Forces (PMF), including Kata'ib Hezbollah and Harakat Hezbollah al-Nujaba, which have been sanctioned by the U.S. government. Iran's provision of UAVs to its proxies serves to amplify its military and political influence in Iraq. There have not been many open-source reports of Iraqi Shi'a militias using Iran-supplied drones, but it appears, with one notable exception, that the militias' sporadic usage of drones was primarily centered on reconnaissance against ISIS.

IRGC Quds Force Commander Qassem Soleimani exploited the ISIS crisis to [ramp up exports of military hardware](#) to Iran-backed forces, who began de facto working alongside the American forces they previously fought against in the battle against the Islamic State. During this period, images posted on social media taken by members of Iran-backed militias, as well as interviews with militia members, indicated an Iranian effort to arm its militias with surveillance drones.

In May 2015, the Badr Organization published [photos](#) of what appeared to be an Oghab-1, a small, portable tactical reconnaissance drone manufactured by an Iranian aerospace company, Farnas Pasagard. In an interview with [Reuters](#), a senior Badr Organization official detailed how Iranian military advisors had helped the PMF eclipse the power and influence of the Iraqi army, trained for years by the U.S. military, by providing training in drone usage and signals intelligence. According to the official, "The U.S. stayed all these years with the Iraqi army and never taught them to use drones or how to operate a very sophisticated communication network, or how to intercept the enemy's communication. The Hashid Shaabi (PMF), with the help of (Iranian) advisers, now knows how to operate and manufacture drones."

Iran has reportedly provided several of its proxies with the [Yasir](#), a reverse-engineered Iranian copy of the Boeing ScanEagle unveiled in September 2013 with ISR and targeting functionality. Iran likely provided access to this platform to its proxies to test its battlefield utility to gauge whether it could be trusted for use on a wider scale by Iranian forces. The former commander of Jund al-Imam Ali appeared in a [video](#) with the Yasir in August 2015. A press secretary for Harakat Hezbollah al-Nujaba [confirmed](#) in 2017 that his group had received at least six Yasir variants from Iran. In December 2014, Iranian media displayed pictures of Yasirs with the militia's [insignia](#) on them, noting the group had used them on the Al-Ishaqi front lines within Salah ad Din Governorate of Iraq.

Iran has also outfitted [Kata'ib Hezbollah \(KH\)](#) – the most powerful and loyal to Iran militia in Iraq, whose leader, Abu Mahdi al-Mohandes was Qassem Soleimani's right-hand man in Iraq and was killed alongside Soleimani on January 3, 2020 – with drones. Video footage [released in 2015](#) by KH indicates that Iran has provided the group with the Ababil-3, referred to by the group as the Basir-1, which it used to surveil ISIS. According to interviews with KH fighters, the group used Iran-supplied drones in the Third Battle of Fallujah. "The Iranian drones allow us to distinguish between civilian areas and ISIS areas. The

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drones are only deployed on occasion. When we don't need them for specific objectives, the engineers keep them in storage for the sake of secrecy," [said](#) a militiaman in al-Saqlawiyah. A contractor for the Iraqi Ministry of Interior noted that KH had the most advanced drones in Iraq, asking "Can the Americans please give us drones like that?"

KH [reportedly](#) houses most of its drones at Camp Speicher, an Iraqi Air Force academy and former U.S. military base outside Tikrit where ISIS massacred over 1500 non-Sunni Iraqi soldiers in June 2014. After the recapture of Tikrit, led by PMF forces operating out of Camp Speicher in April 2015, KH reportedly began using the air bases for two 3 km. runways for its drone operations.

Iranian UAVs in the hands of its proxy militias was not judged to be a threat during the period where the fight against ISIS was paramount. However, the potential that these and other weapons would eventually be commandeered in the fight against the U.S.'s presence and interests in the region remained extant. In May 2019, that danger appeared to come to fruition.

The month prior, the U.S. [designated](#) Iran's Islamic Revolutionary Guard Corps (IRGC) as a Foreign Terrorist Organization and [declined to reissue waivers](#) allowing eight select countries to continue importing Iranian oil, ratcheting up tensions with Iran as the country faced cascading economic pressures and saw no hope for the resumption of European trade and investment on the horizon. The situation placed Iran at a crossroads; it could either swallow its pride and return to the negotiating table having ceded its leverage in order to sue for sanctions relief, or it could pursue a path of stepped up aggression in the hopes that imposing costs on the U.S. and its allies would force the U.S. into negotiations on Iran's terms. Iran chose the latter path.

According to intelligence reports, Soleimani met with Iraqi Shia militia leaders and told them to prepare for a [proxy war](#) against the U.S. in late April 2019. The U.S. responded by dispatching an aircraft carrier and bomber task force to the Persian Gulf to send the message to Iran that attacks on U.S. personnel would lead to reprisals against Iran. Soleimani blinked and opted against direct hostilities against U.S. forces, as Iran did not desire a full-scale conflict with the U.S. that would threaten its hard-fought military entrenchment in Iraq, Syria, and Yemen. Instead, Iran and its proxies instead embarked on a campaign of aggression against secondary U.S. interests, launching a spate of attacks targeting oil tankers in the Gulf of Oman and Saudi infrastructure.

One of the first attacks in this campaign was a [drone attack on May 14, 2019](#) against Saudi Aramco oil pumping stations in Al-Duwadimi, 330 km. west of Riyadh. Initially, the Yemeni Houthi rebels [claimed responsibility](#) for the attack, which ignited a fire that damaged one of the pumping stations and led Saudi Arabia to temporarily shut down a major pipeline, citing Saudi "aggression" and "genocide" in Yemen. However, a month later, [the U.S. assessed that the attack had actually originated from Iraq](#), not Yemen, implicating Iran-backed militia forces. According to Michael Knights of the Washington Institute for Near East Policy, based on interviews with Iraqi political and security figures, the drone attacks [emanated from Jurf as-Sakr](#), Kata'ib Hezbollah's stronghold on the outskirts of Baghdad. The Associated Press also [reported](#) that an Iraqi security official was told by the U.S. that the drones were launched from Jurf as-Sakr.

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U.S. officials were not forthcoming about how they arrived at their assessment, but did say that the drone attacks [displayed a level of sophistication previously not seen in Houthi drone attacks](#). An official familiar with the investigation also noted that based on the wreckage of the attacks, the drones and explosives used were different from those the Houthis had previously used in Saudi Arabia. Based on this description of wreckage at the site, it is likely that the attack was kamikaze-style. In September 2019, following the major drone and cruise missile attacks on Abqaiq and Khurais, the Saudi Ministry of Defense released slides of the wreckage from the May 14 incident for the first time showing that triangular, [“delta-wing” suicide UAVs were used in both the May and September attacks](#).

The slide showed an image comparing the May 14 wreckage to a drone [displayed at an IRGC Aerospace Force exposition in May 2014](#) called the Toofan (Tempest). The Toofan is a previously rarely-seen loitering munition UCAV that, according to a description in IRGC-linked Tasnim News, is small, high-speed, capable of an “undetected launch,” has a low radar signature, and uses an optical tracker to [“locate and destroy the enemy.”](#) Tasnim continues, “This drone’s top speed is 250 km./hr. and it can fly for over an hour. It was designed from the outset for suicide missions... After several attacks from such drones, the enemy will panic.” Analysts posited that the UAVs used in the May 14th drone attack were not Toofans, but an updated, smaller design based on the Toofan’s delta-wing shape with longer range and flight endurance.

The site of the attacks was roughly 500 km. from the Iraqi border, but 800 km. from the Yemeni border, making it more feasible that the attacks originated in Iraq. Saudi Arabia’s air defenses were largely oriented toward combating the drone and missile threats emanating from Yemen, meaning a UAV launched from Iraq would have a better chance of penetrating Saudi airspace.

Neither the Houthis nor Katai’b Hezbollah were known to have drones capable of traveling the distance required to pull off the May 14th attack. If indeed the attack was carried out by Kata’ib Hezbollah, the likeliest culprit based on the press reports of the incident, given its control over Jurf as-Sakr and role as the strongest Iran-backed Iraqi Shi’a militia, it would indicate that Iran has provided the group with UCAVs more advanced than the Ababils it was known to possess in recent years. It cannot be ruled out that IRGC operators were directly involved in the attack.

In addition to threatening Iraq’s neighbors, drones in the hands of Iran-backed militias can threaten U.S. military personnel in Iraq. Shi’a militias have launched numerous crude rocket and missile attacks at U.S. forces and the U.S. embassy in Baghdad since May 2019. Drones that were previously used for surveillance and targeting of ISIS can potentially be used by these militias to improve the accuracy of their salvos against U.S. forces, or to carry out aerial attacks themselves. According to a [Reuters interview](#) with an Iraqi security official, “they used Katyusha [rockets] and mortars in very restricted attacks against American interests in Iraq to send a message rather than trying to inflict damage. Using explosive-laden drones is very possible once we have a worsening situation between Tehran and Washington.”

This eventuality appears to have come to fruition for the first time in April 2021. Reuters [reported](#) that an explosives-laden drone dropped TNT in an attack targeting U.S. forces stationed near an airport in the

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Iraqi Kurdistan city of Erbil. The attack, which was not claimed but was praised by an Iranian-aligned militia, came amid an uptick in rocket attacks targeting U.S. military personnel stationed in Iraq.

Drones in the hands of Iran-backed Shi'a militias undermine the Iraqi government's efforts to assert sovereignty over its territory and risk ensnaring Iraq in Iran's broader conflict against the U.S. and its allies. Incidents such as the May 14, 2019 attack, in which Iran-backed militias likely used Iraqi territory to launch long-range drone attacks against a neighboring state, leaves the Iraqi government with only bad options. Indeed, the risk remains for Iraq's government as after the deaths of Qassem Soleimani and Mohsen Fakhrizadeh, the IDF has [warned](#) of the possibility of drone and missile attacks from Iran's Iraq-based militias as well as the Houthis in Yemen. Baghdad can either act to rein in the militias itself and risk blowback from Iran, or risk outside actors launching kinetic reprisals against militias in Iraq in an effort to curb Tehran's influence.

Houthis

Iran's hegemonic ambitions extend to Yemen as well, giving the Iranian regime added strategic depth. In a similar vein to Iran's efforts to establish forward operating bases in Syria and Lebanon from which to encircle, threaten, and provoke Israel, Yemen offers Iran a staging ground for the Houthi rebels it backs to attack key U.S. allies and Iranian adversaries, Saudi Arabia and the United Arab Emirates.

Beginning in 2004, the Houthi rebels waged a low-level insurgency against the Sunni-dominated, internationally recognized Yemeni central government, a key U.S. counterterrorism ally. Iran and Hezbollah offered limited assistance to the Houthis since at least 2009 in the form of arms and training, with the IRGC-Quds Force organizing crude Iranian small-arms shipments that were occasionally intercepted by [Yemeni and U.S. naval patrols](#).

In September 2014, the Houthis became a more significant player in Tehran's regional ambitions when they exploited the weakness of Yemen's central government and seized the capital of Sana'a [without firing a shot](#). Former Quds Force Commander Qassem Soleimani remarked that the fall of Sana'a represented a "[golden opportunity](#)" for Iran. Iran's aid to its Houthi proxies has provided a low-risk, cost-effective avenue to becoming the dominant political and military influence in Yemen. Acting in conjunction with [Hezbollah](#), the Quds Force stepped up their efforts to arm and train the Houthi in order to rapidly enhance their military capabilities. The Quds Force stepped up illicit arms exports of increasingly sophisticated weaponry, including kamikaze aerial drones, in violation of the arms embargoes in UNSCR 2231, which proscribes Iran from buying or exporting arms, and [UNSCR 2216](#), which bans the Houthis from importing arms.

Within four months of their takeover of Sana'a, the Houthis had toppled the central government and expanded the territory under their control south to Aden and westward to the strategic port of al-Hudaydah. In 2015, a U.S.-backed, Saudi-led Arab coalition intervened in the conflict, blunting the Houthis territorial expansion and turning the conflict into a [war of static positions](#). Since that time, the Houthis have increasingly sought to take the fight to the Saudi and Emirati homelands – two key regional partners leading the Arab coalition against the Houthis – emulating Hezbollah's strategy from 1992-2000 against Israel when the group launched frequent terror attacks within Israel to compel

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Israel's withdrawal from Lebanon. In this instance, the Houthis are seeking to compel the Saudi-led coalition to end their military campaign against the Houthis and accept the territorial status quo.

Drones have played a significant role in the Houthis efforts to sow terror against coalition targets both inside Yemen and within Saudi Arabia and the UAE. In March 2019, U.S. CENTCOM Commander Joseph Votel [testified](#) before the House Armed Services Committee, "The ballistic missile threat and armed UASs (Unmanned Aerial Systems) emanating from Yemeni territory continue to pose a significant risk, as the Houthi's consider civil infrastructure as legitimate military targets." The group's frequent usage of UAVs and demonstration of long-range drone suicide attack capabilities places them in league with Hezbollah as among the world's most active and sophisticated non-state actors in the drone space.

UAVs in the Houthis hands are not game-changing weapons, and are not enough to significantly alter the military balance of power which heavily favors the Arab coalition fighting the Houthis. However, the Houthi's UAVs have an important psychological component, showing that the group can penetrate the territory, launch reprisals, and inflict costs against militarily superior adversaries. As was the case with its other proxies it has furnished with UAVs, Iran's provision of UAVs to the Houthis has allowed it to rapidly field a makeshift air force with both ISR and combat capabilities. The conflict in Yemen has provided Iran a testing ground for strategies to probe and circumvent enemy air defense systems.

The Houthis [reportedly](#) began using UAVs in early 2016 for ISR purposes and soon began deploying them in an attack role as well. The full extent of the Houthi UAV program, including its links to Tehran, first came to light in early 2017. On February 10, 2017, the group's leader, Abdel Malik al-Houthi announced that the Houthis had [started manufacturing UAVs](#). Later that month, the Houthi's Supreme Political Council put on an [exhibition](#) in which they displayed supposedly domestically manufactured drones built by their defense ministry.

Per Iranian [media](#), the "Yemeni armed forces," which is how Iran refers to the Houthi rebels, "unveiled four domestically designed and manufactured drones to collect information on the positions and movements of militiamen loyal to resigned president, Abd Rabbuh Mansur Hadi, as well as Saudi troops, and carry out aerial attacks against them." Three of the UAV systems unveiled by the Houthis, the Hudhud-1, Raqib, and Rased, were strictly surveillance drones, none of which could fly more than two hours nor had a range beyond 35 km. One of these, the Rased, was reportedly [a low-cost, commercially available Skywalker X-8 drone](#), showing the group was inflating its drone production capabilities.

The fourth UAV, referred to as the Qasef (Striker)-1, was a combat drone with a flight endurance of two hours, an operational range of 150 km., and capable of carrying a 30 kg. payload. According to the Houthis, the Qasef-1 was "[equipped with a smart system to detect, monitor, and hit the target with several types of warheads, subject to the target type.](#)" The Qasef-1 is believed to be intended solely for kamikaze-style drone strikes. Researchers who have examined recovered Qasef-1s noted that the drones [have no landing gear, but do have components for arming and initiating explosives](#), highlighting its role as a single-use disposable strike munition.

Both Iran and the Houthis publicly denied that the Houthi drone arsenal was provided by Tehran. Per a press statement released by the Houthis announcing the unveiling of its drone program, the group's

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purported ability to manufacture drones “[was achieved at the hands of a few creative Mujahideen men, bypassing various difficulties and obstacles.](#)” The fiction of the Houthis indigenous design and manufacture of its UAVs has been exposed, however, by arms control researchers and by the U.N. Panel of Experts on Yemen.

In March 2017, Conflict Armament Research (CAR), a U.K.-based investigative organization that tracks the supply of weaponry into conflict zones, issued a [report](#) indicating that the Houthi’s Qasef-1s were provided by Tehran. According to the report, CAR researchers examined seven Houthi Qasef-1 UAVs in the possession of UAE forces, six of which were intercepted by the UAE’s Presidential Guard in Yemen’s Marib governorate and another that crash-landed by Yemen’s Aden International Airport.

CAR found that the Qasef-1 was not indigenously produced by the Houthis, but was actually “consistent with descriptions and imagery of a UAV that has been referred to as the Ababil-T.” In addition to having identical design and construction characteristics, the Qasef-1 and Ababil-T also shared identical serial number prefixes. Components within the UAV also pointed to their Iranian provenance. The Qasef-1s recovered in Yemen all had a vertical gyroscope made by an unknown manufacturer with a sticker indicating they were Model: V10. The V10 vertical gyroscopes matched the gyroscope of an Ababil-3 downed in Iraq and displayed by ISIS and, based on serial numbers, were found to have likely been [manufactured in the same batch series](#) as those found in Iraq. Additionally, UAE forces claimed that they intercepted six disassembled Qasef-1s after they transited Oman, [a known overland smuggling route for the Iranian supply of weaponry to the Houthis](#). Taken together, CAR concluded based on the evidence that the Qasef-1 UAVs were likely imported from Iran and reassembled by the Houthis, not domestically manufactured.

The U.N. Panel of Experts (PoE) on Yemen corroborated CAR’s findings in a [January 2018 report](#). The PoE found that, “the medium-sized Qasef-1 unmanned aerial vehicle is virtually identical in design, dimensions and capability to that of the Ababil-T, manufactured by the Iran Aircraft Manufacturing Industries (HESA).” The PoE further found that Iran tried to conceal the funding and supply of the Qasef-1s in circumvention of the arms embargo in UNSCR 2216. According to the PoE report, “The route for the funding of one of the components used a third party broker, and an intermediary account in a third country. This is indicative of a deliberate attempt to disguise the final destination of the components. The Panel finds that, based on: (a) the design of the unmanned aerial vehicles; and (b) the tracing of component parts, the material necessary to assemble the Qasef-1 unmanned aerial vehicles, emanated from the Islamic Republic of Iran.”

In interviews with UAE forces, CAR further found that Houthi forces had been using the Qasef-1 since 2016 for kamikaze attacks on Saudi and UAE MIM104 ‘Patriot’ surface-to-air missile systems, used to combat enemy missiles and aircraft. The Houthis reportedly used open-source GPS coordinates of the Patriot air defense batteries and would preprogram the Qasef-1, laden with explosive warheads, to fly into the systems’ radar sets. With the systems’ radar disabled, the [Houthis would be able to launch volleys of missiles at coalition personnel and assets unhindered](#).

While it was not clear from the CAR report whether the Houthis had succeeded to date in disabling any coalition Patriot missile batteries, the fact that the topic was broached showed the utility to Iran’s

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asymmetrical proxy war strategy of arming the Houthis with kamikaze drones. The Houthis have Iran-supplied rockets and ballistic missiles in their arsenal capable of reaching Riyadh, and as a result, Saudi Arabia's Patriot batteries near the Saudi-Yemeni border [have been active](#) since the onset of the Yemen conflict. Forcing the coalition to expend multi-million dollar Patriot missiles to defend against cheap, armed drones would represent a small victory for the Houthis, and actually taking out one of the batteries' radar system would be a major accomplishment. While the cost of taking out Houthi drones is exorbitant, the cost of inaction could potentially be greater if missiles, or the drones themselves are able to target Saudi civilians or infrastructure unhindered. The introduction of the Qasef-1 to the Houthis served as a potent example of Iran's plans to degrade the efficiency of high-end anti-aircraft defense systems with cheap UAVs and highlights the need for the U.S. and its allies to invest in more cost-effective counter-drone solutions.

Beginning in 2018, the Houthis began incorporating drones in sporadic cross-border attacks against Saudi and Emirati civilian and military targets. Sometimes the attacks featured just drones and other times, drones were used in conjunction with missile attacks, which have been ongoing since the onset of the Saudi-led coalition's campaign against the Houthis.

In April 2018, Saudi Arabia [reported](#) that it thwarted multiple attempted attacks by the Houthis, including a missile targeting Riyadh and drones targeting an airport and Aramco facility in the country's south. Saudi authorities claimed that its forces downed two Houthi drones, one targeting an Aramco oil facility in Jizan and the other targeting an airport in Abha, both near the Saudi-Yemeni border. The airport temporarily suspended all flights due to the attack, which reportedly injured two airport workers. The Houthi's TV station announced that the Houthis had sent two Qasef-1s to disrupt Saudi air traffic and target its oil industry in response to "Saudi-American crimes against Yemenis." On May 26, 2018, Saudi Arabia reportedly [foiled](#) another drone attack on the Abha airport.

Initially, the Houthi's ability to carry out cross-border drone attacks was limited by the 150 km. range of the Qasef-1. However, by mid-2018, the Houthi's developed a new family of drones, the Sammad. The Houthis began using Sammad variants for attacks beginning in mid-2018, but did not formally unveil the system until July 2019. At that time, Iran's Press TV [reported](#) that Houthi forces had begun using the Sammad-1, a reconnaissance drone, and Sammad-3, described as a long-endurance UAV. Press TV also reported on a new, upgraded Qasef variant, known as the Qasef-2K, but it is not clear how the new Qasef differs from the Qasef-1.

In September 2019, Press TV gave further details on the [specifications](#) of the Sammad drones. The Sammad-1 is an ISR drone with a range of 500 km. Press TV reported that the previously unannounced Sammad-2 was a combat drone with an operational range of 1,300 kilometers, equipped with advanced signal jamming technology, and capable of performing tactical and stealth maneuvers. The Sammad 3 was reported to be a stealth combat drone with an operational range of 1,700 kilometers, capable of hitting the target from above or destroying the target in a kamikaze attack.

According to its January 2019 [report](#) on Yemen, the U.N. PoE said that it had inspected five drones of a new UAV model which it believed corresponded with the Houthi descriptions of the Sammad 2 or 3. The presumed Sammad 2/3s were characterized by V-shaped tail fins and a more powerful engine than the

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Qasef-1, and some were weaponized with 18 kg. explosive warheads mixed with ball bearings to increase their lethality. The PoE further noted that the Sammads were powered by “Chinese-made DLE 170 or the German-made 3W110i B2 engine, with a top speed of between 200 km/h and 250 km/h, the unmanned aerial vehicle may have a maximum range of between 1,200 km and 1,500 km, depending on wind conditions. It would give credence to the claims by the Houthis that they have the capability to hit targets such as Riyadh, Abu Dhabi and Dubai.” The Sammad does not appear to have an existing Iranian analog drone, suggesting that the Houthis have developed some indigenous UAV design and production capabilities. CAR [found](#) in February 2020, however, that the Sammad shared components in common with other Iran-supplied UAVs and IEDs that have proliferated around the region, implying that the drone is at least partially Iranian in origin.

The first claimed Houthi usages of Sammad-2 or 3s for attack purposes came in July 2018. On July 18, 2018, Houthi media [reported](#) that Houthi drone forces had attacked an Aramco oil refinery in Riyadh with a Sammad-2, causing a fire. Aramco denied that any drone attack had taken place, but did acknowledge that there had been a fire at the Riyadh refinery due to an “operational incident.” The Houthis did not produce any evidence to corroborate an attack on the facility, indicating the incident may have been fabricated for propaganda purposes. In May 2019, however, the Wall Street Journal [reported](#) that an Aramco executive and an anonymous Gulf security official acknowledged that the Houthis had in fact attacked the refinery with a drone.

On July 26, 2018, the Houthis [claimed](#) to have attacked Abu Dhabi’s international airport in the UAE with a Sammad-3 UAV. According to a Houthi spokesman, the drone travelled 1,500 km. in order to hit its target and made clear the Houthis intention and ability to target civilian infrastructure in Saudi Arabia and the UAE. The UAE denied any drone attack had occurred, but did acknowledge an incident had taken place that day involving a supply vehicle. If an attack did occur, it would represent a major escalation in the Houthis UAV capabilities, as the UAE has sophisticated air defenses, including the Theater High Altitude Area Defense (THAAD) anti-missile system.

The Houthis again released no corroborating evidence at the time, nor did any of the thousands of passengers who transit the airport daily report or film a drone attack, suggesting another Houthi fabrication. In May 2019, almost a year after the alleged attack, Houthi media [posted](#) a video purporting to show the UAV attack on the Abu Dhabi airport, the first reputed footage of the incident. In [August](#) and [September](#) of 2018, the Houthis claimed to have attacked Dubai’s international airport with Sammad 3s, but in both instances, the UAE denied any attack had taken place and the Houthis released no corroborating evidence.

On July 24, 2018, UAE forces in Yemen [reportedly](#) intercepted two Houthi drones armed with explosives that were sent to target troops affiliated with the internationally-recognized Hadi government. According to the UAE state media service, “One was headed towards the district of Al Mokha and the second towards densely populated cities in the district of Al Khokha in the Hodeidah province.” The incident underscored that the Houthis had quietly been undertaking ongoing drone operations inside Yemen in addition to the headline-grabbing cross-border drone attacks it has sporadically attempted. According to Khalil Dewan of the investigative journalism outlet Bellingcat, the Houthis [claimed](#) on July

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26, 2018 to have executed at least 16 drone attacks within Yemen targeting coalition and pro-Hadi forces.

In January 2019, the Houthis [flew an explosives-laden drone](#), claimed by the Houthis to be the Qasef-2K, into a coalition military parade outside the southern port city of Aden, targeting high-ranking military officials of the internationally-recognized government and killing at least six. One of those killed in the strike was [Major-General Mohammad Saleh Tamah](#), chief of the Yemeni army's military intelligence unit. The Houthis immediately claimed the attack, declaring they targeted "[mercenaries and invaders](#)" and [left "dozens of dead and wounded."](#) [Footage](#) of the drone strike showed that the UAV directly targeted a podium where security officials were seated listening to speeches. The buzz of a drone can be heard seconds before a large explosion, followed by a commotion. The drone attack demonstrated sophisticated planning by the Houthis, who had a limited window to strike the dais while it was filled with high-value targets. The strike is believed to have been the [first instance](#) of a non-state actor using UAVs to assassinate a government official.

In December 2020, the Houthis [reportedly](#) made use of an explosives-laden drone in a two-phase terrorist attack targeting cabinet officials of the newly formed Riyadh-backed, internationally recognized government returning from exile to Aden, Yemen. In the first phase of the attack, the Houthis allegedly fired four ballistic missiles at Aden's international airport shortly after a plane carrying the cabinet officials landed there, killing at least 25 civilians and wounding over 100. The cabinet officials were then transferred to a palace in Aden for safety and were subsequently targeted by an explosives-laden drone, which the Saudi-led coalition successfully shot down.

When U.S.-Iranian tensions ratcheted up after the April 2019 designation of the IRGC as a terrorist organization, the Houthis took on an expanded role in Iran's regional destabilization efforts, stepping up its drone and missile attacks against the Saudi-led coalition and frequently targeting civilian and military infrastructure within Saudi Arabia. The Houthis [warned](#) at the time that they had identified 300 coalition military targets that they planned to launch operations against. The following is a timeline of reported Houthi drone attacks since that time, primarily targeting airports, cities, and other civilian infrastructure.

- **April 2, 2019:** The Saudi-led coalition [intercepted](#) two Houthi drones it claimed were targeting the Saudi city of Khamis Mushait. Five civilians were reportedly injured by falling debris from the drone interception.
- **April 8, 2019:** The coalition [intercepted](#) a Houthi drone launched toward the city of Asir.
- **May 14, 2019:** The Houthis [claimed credit](#) for a drone attack targeting two Aramco pumping stations. The attack was judged by the U.S. to have emanated from Iraq, however. The Houthis' willingness to shoulder the blame for the attack demonstrated their loyalty to Iran and willingness to shield Iran and its other proxies from possible reprisals for their malign activities.
- **May 21, 2019:** The Houthis claimed via their TV network to have [launched](#) a drone attack using a Qasef-2K targeting an arms depot at Saudi Arabia's Najran airport, a civilian airport near the Saudi-Yemeni border that houses a military base as well. A coalition spokesman alleged that the Houthis targeted a civilian site in Najran.
- **June 11, 2019:** The Houthis [claimed](#) to have launched two Qasef-2K drones targeting the city of Khamis Mushait. The coalition reported that its soldiers intercepted the drones.

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- **June 13, 2019:** Saudi Arabia [claimed](#) that its air defenses shot down five Houthi drones targeting the Abha airport and the city of Khamis Mushait.
- **June 15, 2019:** The Houthis [claimed](#) to have carried out drone strikes on a control room at Jizan airport and a fuel station at Abha airport. The coalition acknowledged intercepting a Houthi drone approaching Abha. Following the purported attacks, a Houthi spokesman declared, "The two airports are now out of service. We promise the Saudi regime more painful days as long as the aggression and siege continue on our country."
- **June 20, 2019:** Saudi Arabia [claimed](#) that its air defenses shot down a "hostile drone" launched by the Houthis toward Jizan.
- **June 23, 2019:** Saudi Arabia [alleged](#) that the Houthis launched a drone attack against the Abha airport 200 km. north of the Yemeni border, killing one and wounding 21.
- **June 30, 2019:** The Houthis [claimed](#) to have launched two Qasef-2k drones targeting airports in the Saudi cities of Abha and Jizan. Saudi Arabia claimed to have intercepted the drones, and reported that no damage or casualties were sustained.
- **July 2, 2019:** The Houthis [claimed credit](#) for a drone attack targeting the Abha airport that wounded eight Saudi nationals and one Indian national. In response, a coalition spokesman said, "The terrorist Houthi militia is continuously and immorally targeting civilians. The continuation of these terror attacks in an advanced manner proves the Iranian regime's involvement in supporting the terrorist Houthi militia."
- **July 15, 2019:** The Saudi-led coalition [reported](#) that it had intercepted three Houthi drones launched toward Jizan and Abha. The Houthis were allegedly targeting the King Khalid air base.
- **July 16, 2019:** The Houthis [claimed](#) to have launched a drone targeting the Jizan airport and that the attack disrupted airport operations. The coalition reported that its forces intercepted and downed a drone headed toward civilian targets in Jizan.
- **August 5, 2019:** The Houthis [claimed](#) to have launched drone attacks targeting the King Khalid Air Base and civilian airports in Abha and Najran. According to the Houthis, the attack on Abha hit its target, and air traffic was disrupted at both civilian airports. However, the coalition claimed that it intercepted the drones before they reached the airports.
- **August 17, 2019:** The Houthis [claimed](#) to have carried out a complex, long-range drone attack targeting Aramco's Shaybah natural gas liquefaction facility over 1000 km. away from Yemen's northern border. A Houthi military spokesman claimed that the group used ten drones, alleged by Saudi Arabia to be "booby-trapped," in the attack. The attack reportedly sparked a fire but did not cause casualties or disrupt production. The Saudi energy minister denounced the attacks, which he said were "not only aimed at Saudi Arabia but also against the global economy."
- **August 26, 2019:** The Houthis [claimed](#) to have launched an armed drone attack targeting a military site in Riyadh, but Saudi Arabia denied any attack had taken place.
- **September 14, 2019:** The Houthis initially [claimed](#) credit for the coordinated drone and cruise missile attacks on Aramco's Abqaiq and Khurais oil facilities. The [U.S.](#) and [U.N.](#) have rejected the Houthis claims, with the U.S. attributing direct responsibility for the attacks on Iran.
- **March 27, 2020:** The coalition reported that it intercepted and destroyed Houthi UAVs launched toward civilian targets in Abha and Khamis Mushait.

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- **March 28, 2020:** The Houthis [claimed](#) to have attacked “sensitive” sites in Riyadh with Zulfiqar ballistic missiles and Sammad-3 UAVs. They additionally claimed to have carried out rocket and drone attacks on Saudi targets closer to the Yemeni border in Jizan, Najran and Asir.
- **May 27, 2020:** The coalition [reported](#) that it intercepted and destroyed Houthi UAVs launched at civilian targets in Najran.
- **June 1, 2020:** The coalition [reported](#) that it intercepted and destroyed two Houthi UAVs launched at civilian targets in Khamis Mushait.
- **October 25, 2020:** The coalition [reported](#) that it intercepted and destroyed two explosives-laden Houthi UAVs targeting civilian sites in southern Saudi Arabia. The Houthis claimed one of the drones launched attacked the Abha International Airport.

Having lacked any drones as recently as 2015, the Houthis rapidly amassed a drone arsenal, introduced new systems capable of long-range attacks, and stand today as one of the world’s most active and adept non-state actors in terms ofUCAV operations. While the Houthis have gained some domestic drone manufacturing capabilities, their rapid ascent could not have been achieved without Iranian efforts to smuggle drones and components to the Houthis, nor without Quds Force and Hezbollah training. In November 2019, the U.S. [seized](#) an Iranian shipment of weaponry, including components matching those found in Qasef and Sammad drones, indicating Iran’s efforts to proliferate drones to the Houthis are ongoing. The U.S. similarly [interdicted](#) another weapons shipment in February 2020. The U.N. secretary general [found](#) in June 2020 that both shipments were Iranian in origin and may have been transferred “in a manner inconsistent” with U.N. Security Council Resolution 2231.

Due to Iran’s backing, the Houthis pose a persistent drone threat to Saudi Arabia, and to a lesser extent, the UAE. Even with large investments in advanced air defenses, the Houthis have managed, using a high volume of attempted drone attacks, to cause damage to civilian and military infrastructure with pinpoint accuracy on numerous occasions with their UAVs. Drones form an integral part of the Houthi’s military posture toward the Saudi-led coalition, and their utility goes beyond mere harassment. The Houthi’s frequent drone attacks are intended to compel the Arab coalition from continuing its military campaign against the Houthis and accept the Houthi’s territorial gains. They are important psychological tools for the Houthis, which focus on drone attacks significantly in their production of propaganda. Drones demonstrate that the Houthis, formerly considered to be a localized, tribal insurgency have evolved into an organized militia capable of defying regional powers.

The September 2019 Attacks on Abqaiq and Khurais

On September 14, 2019, Iran carried out a complex operation using UAVs and cruise missiles against Saudi Aramco oil facilities at Abqaiq and Khurais. The industrial complex at Abqaiq is said to house the largest crude oil stabilization plant in the world, according to Aramco, and is responsible for 7% of global oil production. The Khurais oil field has the capacity to produce [1.5 million barrels of crude oil per day](#). The attack knocked out half of Saudi Arabia’s daily crude production for several days, representing [5% of global daily oil production](#). Past Houthi and Iranian attacks on energy infrastructure had only caused limited damage. The Abqaiq and Khurais attacks caused significant disruptions to global energy markets. The Iranian attack was the clearest indication to date of how far Iran’sUCAV capabilities have matured, and demonstrated that experts’ worst fears have come to fruition: Iran is now capable of attacks

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targeting critical infrastructure using simultaneous drone swarms and missiles to overwhelm enemy air defenses.

The Abqaiq facility sustained 18 strikes from weaponized UAVs, while the Khurais facility was hit four times by cruise missiles. An additional three cruise missiles were found crashed in the desert in the vicinity of Abqaiq, and the U.N. PoE on Yemen [concluded](#) that the crashed missiles were likely intended to target Abqaiq. The PoE declared, “The complexity and scale of the attacks is unprecedented and shows a high degree of military capacity.” The UAVs hit a number of stabilizer towers and separator tanks at Abqaiq, and the distribution of the impact points demonstrated a high level of accuracy in the attack.

As they did following the May 14, 2009 drone attacks targeting Aramco pumping stations west of Riyadh, Yemen’s Houthi rebels initially [claimed credit](#) for the Abqaiq and Khurais attacks. Several days after the attack, a Houthi spokesman [stated](#) that attacks had been launched from three different locations, using a combination of upgraded Qasefs and Sammad-3 UAVs, as well as a newly developed jet-powered UAV, reputed to be capable of carrying four precise bombs each. The spokesman further claimed that other drones were used as decoys to confound Saudi air defenses. The Houthis also released a video which they claimed showed one of its UAVs striking the Abqaiq facility, but this footage was believed to be [fabricated](#) as the Houthis lack the beyond-line-of-sight data links it would need to transmit video of the attack.

The U.S. and U.N. PoE on Yemen have both concluded that the Houthis could not have carried out the Abqaiq and Khurais attacks, and the U.S. has [directly accused](#) Iran of being the culprit. The drones used were indisputably Iranian in origin based on components found in the wreckage. Inspectors found vertical gyroscopes of unknown manufacturer but labelled as Model V9. The V9 was similar to the V10 gyroscopes found in Qasef and Sammad drones. Further, it matched a V9 gyroscope that was found in the wreckage of a Shahed-123 that crashed in Afghanistan in 2016. Iran is the only country known to use these specific gyroscopes in their drones.

The U.N. panel’s determination that the Houthis were not the operators of the UAVs used to attack Abqaiq was made based on the ranges of the drones whose wreckage they examined. The UAVs used in the attack were the [same delta-wing loitering munitions](#), a likely variant of the Toofan, used in the May 14th attack on the al-Duwadimi pumping station. The attack sites in Abqaiq and Khurais were at least 1000 and 900 km. away from Houthi held territory, respectively. Based on various estimates of fuel capacity, the maximum range for the delta-wing UAVs would be 540-900 km based on an estimated flight endurance of three hours. However, the delta-wing UAVs in question were judged to have unlicensed versions of a British engine, possibly a Chinese or domestically produced Iranian knock-off. The engines in the delta-wing UAVs consume fuel at a faster rate, and so the UAVs were judged to have a maximum flight endurance of 1 hour and a maximum range of 180-300 km.

Based on these findings, the drones could not have plausibly been launched from Yemen, but could have been launched from southern Iraq, or from across the Gulf in Iran. Lending credence to this theory, the impacts of the drone strikes in Abqaiq were judged to have originated from the north or northeast, not

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the south. Tellingly, Abqaiq suffered drone attacks while Khurais only sustained cruise missile strikes. Abqaiq is further from Yemen and closer to Iran and Iraq than Khurais.

In November 2019, Reuters [reported](#) based on discussions with anonymous Iranian officials that Iranian military leaders planned the Abqaiq attack at a closed-door meeting in mid-May. The attendees were seeking to launch a sensational attack to punish the U.S. for withdrawing from the JCPOA and reimposing sanctions on Iran and settled on Aramco's facilities because it would not cause mass casualties, allowing Tehran to send a message while lessening the chance of reprisals. Supreme Leader Khamenei reportedly signed off on the attack on the condition it would not target civilians or U.S. military personnel in the region. According to a U.S. intelligence official, the UAVs took a circuitous route flying over Kuwait and Iraq before entering Saudi airspace to disguise the origins of the attack. There were [unconfirmed reports](#) of missiles or drone-like objects flying over Kuwait on September 14.

The UAV attacks on Abqaiq and Khurais represented a major intelligence and air defense failure for Saudi Arabia. Despite spending billions of dollars on sophisticated U.S. weaponry, including F-15 fighter jets and Patriot PAC-2 surface-to-air missile batteries, and intelligence sharing with the U.S., the Saudis were caught by surprise and were unable to intercept any of the UAVs or cruise missiles before they hit their targets. According to [Military Times](#), "Patriots provide "point defense" — not protection of wide swaths of territory — and it's unclear whether any were positioned close to the oil sites."

Even after the May 14th attacks, which reportedly emanated from Iraqi territory, Saudi Arabia's air defenses were still reportedly primarily oriented southward toward Yemen, which may help account for why the Saudis failed to detect the September 14th attack. The Saudis did have short-range "point defense" surface-to-air missiles and radar-guided air defense cannons arrayed to protect the Abqaiq facility, but its systems were fairly outdated and not designed to defend against missiles and drones and therefore did not help.

Recommendations and Conclusion

The success of Iran's Abqaiq attack highlighted how drones can equalize the playing field for a conventionally inferior actor, even in the face of the best intelligence and top-of-the-line air defense systems. The attack, which featured simultaneous drone swarms and missile barrages, demonstrated that Iran's investment in combat UAV capabilities over the past decade for itself and its proxies have paid off. In U.S. House testimony delivered in April 2021, CENTCOM head Gen. Kenneth McKenzie warned, "These small- and medium-sized UAVs proliferating across the [area of operations] present a new and complex threat to our forces and those of our partners and allies. For the first time since the Korean War, we are operating without complete air superiority."

U.S. policymakers seeking to constrain Iran's regional hegemonic ambitions must contend with the advancing combat UAV capabilities of Iran and its proxies. Iran and/or its proxies have the capability to utilize drones against U.S. personnel, interests, and allies throughout the region, as well as against civilian populations. Virtually all sensitive sites, including military, nuclear, oil, and petrochemical facilities, are potentially vulnerable to Iranian UAV attacks. The U.S. should:

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Prioritize deterrence of significant, potentially destabilizing drone attacks: In the absence of hermetic air defenses, which are not yet attainable, even for a geographically small country such as Israel, Iran can strike, or at least threaten, any target it wishes within range of its or its proxies UCAVs. The best defense against this eventuality is a strategy predicated on deterrence. Despite its regional adventurism, Iran is a fairly risk-averse actor that rarely engages in direct confrontation with superior powers, preferring to farm out such duties to proxies. It frequently also makes use of methods that provide plausible deniability, such as cyber or UAV attacks. That is why when it took the rare step of directly attacking Saudi Arabia in September 2019, it took pains to obfuscate the origin of the attack, denied culpability, and sought to shift blame to the Houthis.

In taking on such daring operations, Iran shows it is willing to countenance some degree of kinetic reprisal if it is found out. Iran frequently pushes the envelope to see what it can get away with, and likely concluded from the Abqaiq attack that it can continue to target energy infrastructure without incurring significant blowback. The thing Iran fears most and assiduously seeks to avoid is a regime destabilizing reprisal. Without clearly enumerated redlines, Iran is liable to continue testing the waters in provocative ways. The U.S. should stress that Iran will face severe reprisals for significant UAV attacks, and will be held accountable even for the actions of its proxies if it is found to have a hand in their operations.

Invest in counter-drone technologies and bolster air defenses by working collaboratively with allies: The U.S. must ensure that it can defend its assets and personnel in the region, as well as those of its allies, against the multi-layered threat posed by Iran and its proxies' rockets, increasingly precise cruise and ballistic missiles, and UCAVs. The multi-layered Iranian threat necessitates that all U.S. bases and units in the region, Israel, and the Gulf states deploy permanent, day and night, all-weather, 360-degree multi-layered air and missile defenses to defend against short and long-range threats.

Low-flying drones are among the most vexing threat faced by U.S. air defenses in the region. Following the Cold War, Pentagon military planners [downsized](#) the U.S.'s short-range anti-air defenses and prioritized medium and long-range aerial threats instead, focusing on air defense systems like the Patriot to combat ballistic missiles. Armed drones were not a prevalent threat at that point, but they have become one in the past decade. Drones tend to have [small radar signatures, can fly close to the ground, and are highly maneuverable](#), rendering them hard to detect by radar.

The difficulty in consistently detecting drones from afar reduces the efficacy of Patriot batteries against UCAVs. Further, medium and long-range air-defense systems are armed with exorbitantly expensive missiles, making them a less than ideal solution for countering cheap drones. The U.S. should still encourage the Gulf states to invest in theater air defense systems, such as THAAD, to contend with Iran's ballistic missiles and as an added layer of defense against UCAVs. But the U.S. must also urgently prioritize boosting short-range air defense capabilities capable of striking down drones within visual range. The Abqaiq attack demonstrated that all sensitive sites in the region are in need of such defenses. The U.S. should seek to collaborate with Israel on new counter-drone innovations and ensure that as new technologies emerge, they are shared with other regional partners as well. To that end, it was an encouraging development that the [U.S. and Israeli National Security Councils agreed in April 2021](#) "to establish an interagency working group to focus particular attention on the growing threat of unmanned

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aerial vehicles [UAVs] and precision-guided missiles produced by Iran and provided to its proxies in the Middle East region.”

Extend the arms embargo under U.N. Security Council Resolution 2231, set to expire in October 2020:

Finally, the U.S. should advocate for the extension of the Iranian arms embargo contained in U.N. Security Council Resolution 2231, which would keep barriers in place against Iran legally purchasing military-grade drones and components from eager sellers such as China. Although Iran has systematically flouted the provisions of the arms embargo proscribing exports of combat UAVs to its partners and proxies, the embargo’s existence is more than symbolic. It ensures that U.S. interdictions of illicit Iranian arms transfers are justified under international law. The collapse of the arms embargo risks increasingly sophisticated drone technologies falling into the hands of Iran and its proxies, enabling them to further destabilize the region.