



PRECISION PLANNING:

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IRAN'S AERIAL ADVANCES

WHILE being hailed as an expert in a military field is usually seen as a badge of honour, the Kingdom of Saudi Arabia would undoubtedly prefer not to have been forced into earning its crown of interceptor *extraordinaire*.

Its proficiency in defeating aerial assaults is born out of sheer necessity – as [revealed](#) by a representative of the Saudi-led Arab Coalition fighting in Yemen, who declared in February 2021 that the Kingdom had intercepted 526 drones and 346 ballistic missiles launched by the Iran-backed Houthi militia and otherwise bound for its southern cities. The defeat of the barrage, according to the spokesperson, meant “no country other than Saudi Arabia has intercepted this many ballistic missiles and drones”. The number of interceptions, which has grown significantly since, is both

credible and stunning given the attacks began back in 2015 and that the technology behind them continues to evolve.

Of course, Saudi Arabia's need for vigilance highlights the growing expertise of its adversary. Having executed so many unmanned sorties, the Houthis stand out as highly experienced practitioners in the use of ballistic missiles and drones in combat. The answer as to how the Houthis, a once little-known Islamist group, have gone from being reliant on looting the arsenal of the Yemeni army to deploying a steady flow of hi-tech weaponry is well understood and summed up in two words – Iranian support. However, the extent to which Iran is benefitting from its investment, and will continue to do so if its backing of the Houthi is left unchecked, is less widely appreciated. Without directly engaging in conflict itself, Iran is honing its drone and missile capabilities – courtesy of the rigorous test provided by

Saudi Arabia's modern air defence systems – and strengthening its ability to wage war against a well-equipped enemy. This practice is of particular relevance to the global here and now given the Islamic Republic's decision to deepen its strategic alliance with Russia. It is no longer an issue confined to the Middle East, with Iranian-made drones regularly hitting Kyiv and other cities in Ukraine. These weapons are not in Ukraine by chance and nor does their story there start with the first recorded drone strike in Kupyansk in September of this year. Indeed, much of their history was written thousands of kilometres away, in Yemen.

HOW IRAN HONED THE HOUTHI ARSENAL

Iran helped the Houthis develop capabilities in three connected areas and surrounding three key weapon systems. The first leg of the Iranian programme focused on ballistic missiles – relatively common military assets

that draw their name from the arc-like trajectory of their flight path; the predictability of which usually affords interceptors time to mitigate the threat. The accuracy of ballistic missiles tends to drastically decrease at longer ranges, making them indiscriminate tools of psychological warfare (when used in isolation) rather than precision weapons that can be aimed at an enemy's military infrastructure. Still, such weapons can be deadly and were used with a degree of efficiency against Saudi cities (mostly against civilian targets), particularly those closer to the border, until the Kingdom's air defences caught up.

The Houthis and their Iranian partners developed several lines of short- and medium-range ballistic missiles, initially by reactivating and modifying some of the pre-war Yemeni army stocks, using mostly Soviet (Toshka, S-75s and Scuds) or North Korean missiles (Hwasong), before switching to Iranian-designed weapons. This included systems based on Iran's "Qiam" line of missiles, which the Houthis renamed "Burkan". The Burkan 2H missile was used to reach Riyadh and the port of Yanbu as early as 2017. Since then, the group has received newer versions of the missiles. The Burkan 3 or Zulfiqar, based on Iran's Qiam-1 missile, was unveiled in 2019 and used most recently to attack the United Arab Emirates in January of this year. The Houthis also recently displayed a new missile – dubbed "Falaq" – during a parade in Sana'a. Intelligence suggests that this "new" addition to the Houthi armoury is in fact a copy of Iran's "Qiam-2", a missile boasting improved accuracy courtesy of more sophisticated re-entry vehicles.

The group also uses short-range ballistic missiles based upon the Iranian "Fateh" series. The Fateh-110, a GPS-guided missile



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equipped with a manoeuvrable re-entry vehicle (or MaRV) was [likely used](#), for instance, in Iran's relatively precise attack against US troops posted at the Ain al-Asad airbase in Iraq in 2020. The missile (dubbed "Karrar") was spotted during a military parade in Yemen this year, and [reports](#) suggest Russia may be looking to acquire it for its war in Ukraine.

The second pillar of Iranian development surrounded cruise missiles – agile projectiles that can manoeuvre during flight and fly at lower altitudes, thus representing a far greater challenge for air defence systems. The "Quds" line of cruise missiles was used in a series of attacks against Saudi Arabia, with the first Quds-1 being employed to attack an energy facility in Eastern Saudi Arabia in 2019, and the later version being part of a series of weapons used to target the Saudi city of Jeddah this year.

The final leg of Iran's investment in the Houthis is the group's drone programme, centred around both unmanned combat aerial vehicles (UCAVs), which are capable of launching munitions, and the more commonly used "suicide

drones" (or more accurately one-way attack drone/loitering munitions). The Houthis launched their first drone attack in 2016 and have since growingly relied on the "Qasef" line of loitering munitions. The group is known to also be in possession of the Shahed-136, one of Iran's newest drones and a system currently being used by Russia to bomb Ukrainian cities.

Iran's decision to deliver advanced missiles and drones to the Houthi underscores how central the group has become to the Islamic Republic's own drone and missile programme. While Tehran initially kept its most advanced missiles for itself, recent parades in Sana'a and the port city of Hudaydah show this is no longer the case.

This is not a decision Tehran will have taken lightly. Iran's own defensive doctrine, designed to deter foreign invasions or strikes, largely relies on drones and missiles (used alongside anti-ship missiles, fast attack boats and mines) to block the Persian Gulf. Lessons learnt from Yemen are, in that sense, not just a by-product of an effort to gain leverage over Saudi Arabia. They are a key

part of what makes the Iranian investment in Yemen valuable.

LESSONS FROM YEMEN

The Iranian investment in the Houthis has provided the Islamic Republic with a new ally just south of Saudi Arabia. But it also provides Tehran with the perfect opportunity to test its new systems against relatively modern air defence systems. Iranian advisers, alongside other proxies including Hezbollah, have helped develop the Houthi arsenal, but they have also benefited from lessons learnt during years of attacks against the Gulf.

Against relatively sophisticated air defences, the Houthis and their Iranian backers have used different tactics. The initial investment into ballistic missiles was increasingly challenged by the Saudis' use of US-made Patriots. In turn, the Houthis increasingly used ballistic missiles as a tool of psychological warfare aimed at the Saudi home front, betting on missiles with lesser payloads but greater range.

The Burkan 3 and 2H, for instance, have significantly higher ranges than their initial counterpart, the Soviet-made

Scud series and the prior version of the missile. The Iranians likely decreased the payload and extended the fuel tanks to increase reach. At such a range, the chance of hitting a specific target is extremely low. The smaller payload also means that this is not compensated by a higher blast radius. The main use of those missiles is to reach the enemy's home front, shatter its sense of security, and carry out indiscriminate attacks. This resulted in a series of attacks against Riyadh that, though never causing real damage (other than through shrapnel), certainly brought the war closer to the heart of the Kingdom.

Of course, this wasn't enough. The Iranians and Houthis later relied on a new method to cause actual damage: using a mix of the aforementioned three main systems, they looked to saturate air defences. Through the use of drones, short-range ballistic missiles and cruise missiles in the same strike, the group was able to carry out a series of relatively pinpoint strikes. This includes two attacks against energy facilities in Jeddah, one of which occurred during the Formula One Grand Prix race this year.

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This strategy relies on the different flight paths of those systems, with ballistic missiles flying at higher altitudes than cruise and drone missiles. Small and slow flying drones are also more difficult to spot and differentiate from clutter by radars. Saudi Arabia has been able to adapt, through the use of a combination of air defence systems and interception using combat jets, yet thwarting these attacks remains a challenge to this day. Other Iranian opponents, including Israel, have also taken note and started training to mitigate this threat.

Sheer numbers also mean that while most of the projectiles may be downed, others are liable to hit their targets. This was the case

in January this year, when the US Terminal High Altitude Area Defence system intercepted a Houthi missile (likely a Zulfiqar) fired at a military base in the UAE, yet other systems failed to intercept a Houthi drone that hit an area of the Abu Dhabi airport, and a local fuel installation, killing [three](#) and wounding six.

MIXED ORIGINS

Relying on numbers is made possible by the relatively low cost of those systems, and Iran's ability to continue delivering them despite the ongoing blockade of Yemen. Iranian drones and missiles appear to be made of both “homemade” components, and components Iran has been able to procure through complex channels.

More specifically when it comes to the Houthis, although the group claims that the drones and missiles within its arsenal are homemade, it is likely they only produce

some of the simplest parts. In the main, the group likely receives missiles and drones in parts, which it assembles with the help of advisers from the Iranian Revolutionary Guards. [Documents](#) released by the US Central Command in 2020 following the interception of two Yemen-bound ships, for example, showed how the group received key parts of its Qasef drones, including the engines. The shipments also included parts of the “Noor” anti-ship missiles that Iran has been transferring to the Houthis. Another [report](#) by CAR showed that a Sammad drone used an engine manufactured by a company in Germany.

Iran has a history of procuring and/or copying material from abroad for some of its drones and missiles. Wikileaks cables [showed](#) that the US was conscious of Iranian efforts to acquire sophisticated components and machines by re-exporting them through third-party countries as early as 2008-9. In 2019, the UN Panel of Experts on Yemen [examined](#) debris from several Quds-1 missiles used in the unprecedented attack against two energy facilities in the Kingdom and concluded that the cruise



missile used a turbojet engine similar to one produced by the Czech company PBS – with the company later releasing a [statement](#) highlighting that it had never delivered such engines to Iran or Yemen.

Iran itself doesn't produce most of the components within its drones and appears to rely on a complex supply chain that likely involves fronts and third parties acquiring parts the country cannot produce (yet). According to a Ukrainian [report](#) analysing debris from Shahed-136 and Shahed 131 drones, those systems rely on Western-made components, including circuit boards from Texas Instrument.

Interestingly, the Ukrainian report also notes that Russia likely installed more advanced navigation modules, intended to afford additional protection against electronic counter-measures. This may be only the beginning of a jump in quality of Iranian drones as a result of the deepening Iran-Russia partnership. Another [report](#) from *The Wall Street Journal*, quoting Ukrainian intelligence, suggested that three-quarters of the components of Iranian drones downed in Ukraine are American-made, while also reporting the use of Japanese and German components, and even a lens identical to an Israeli-produced model.

This raises the complex issue of sanctions enforcement. In a world where the West is increasingly reliant on sanctions, Iran has effectively been able to import key components from the West and will likely continue to do so until it can produce such components itself – or find companies in friendly countries that can. While the Western military doctrine regarding drones and missiles is to try and block those attacks “left of launch”, blocking those exports is extremely challenging, as Iran



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can easily import components from third-party countries.

The Islamic Republic has also been able to gather significant experience in smuggling those components and weapons in Yemen. Iran managed to establish multiple sea and land routes to Houthi-controlled areas of the country, despite an ongoing Saudi blockade and several international and US-led missions. The Iranian drones and missiles are meant to be simple enough that they can be transferred, re-assembled and used with relative ease, while also being cost-effective. In other words, they are the perfect tool for sub-national entities, and countries under heavy international pressure. In that sense, it is not surprising that those same weapons ended up in the hands of Russia, just as sanctions continue to pile on the Kremlin.

Beyond that, these missiles and drones are meant primarily as a tool of asymmetric warfare. Most (if not all) of the weapons delivered to the Houthis by Iran have navigation systems that rely on GPS coordinates and way points. These weapons tend to not have the flexibility to change target mid-flight or

attack a moving target. Instead, they generally hit fixed targets, making them less relevant when it comes to conventional military fights, and more likely to be used against civilian buildings. To be sure, the Houthis initially tried to use some of those drones and missiles to target Patriot batteries (more specifically their radars) and have at times also been able to hit Saudi air bases close to the border with Yemen. However, the vast majority of the strikes have hit civilian targets or been fired indiscriminately, with the sole goal of waging a war against the Saudi home front. It's no surprise that Russia is now using the exact same strategy, with attacks against the Ukrainian home front, rather than deploying drones against military targets.

WHAT THE FUTURE HOLDS

The deployment of Iranian drones in Ukraine is no anomaly or accident of history: Moscow has come to rely on the same asymmetric tactics that are at the core of the Iranian military doctrine, be it for its own defence against potential invaders, or when it comes to Tehran's support for its proxies. The Houthi and the conflict in Yemen have provided Iran with opportunities to hone its drone and missile

skills against Western-made air defences and adapt against potential countermeasures (most of which are either costly or complex, or both).

This opportunity is, in no small part, the result of a lack of sustained effort to counter Iranian smuggling and military activities in Yemen. The conflict in Yemen has either been ignored, solely dealt with through peace efforts, or used in partisan politics in the US. The perception that Iran's drone and missile programmes are a remote issue solely affecting the Middle East has also driven lower scrutiny and delayed a Western reaction.

If given the chance, Iran and its proxy in Yemen will continue to adapt their strategies, as well as their drone and missiles, to be more efficient and cost-effective. To be clear, Iranian drones and missiles are unlikely to ever be a match for their Western counterparts. Iran is liable to trail behind developments on this front. But those weapon systems provide Iran and its partners (current and future) with a way to challenge their opponents' military superiority and bring the war closer to their home front. Iran will be able to learn even more from its deepening partnership with Russia, particularly if [reports](#) that Russia may begin to produce Iranian-designed drones are true.

Even as it trails behind, if left unchecked, Iran will also be able to slowly complexify its tactics and weapon systems. Drone and missile warfare is just at the beginning of a long history, as it continues to benefit from technological advances in multiple domains. While Iran may not be at the tip of the spear in that field, it will still be able to provide regional proxies and Western adversaries with a cheaper yet still lethal alternative to the more costly programmes of the West.