

Proliferation of Iranian missile technology in the Middle East

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IRAN POSSESSES THE largest missile arsenal in the Middle East. Its domestic programme to develop and manufacture ballistic missiles is intended to create a deterrence posture and increase its influence in the region.⁽¹⁾ Within the context of its conflicts with Israel, the United States, Saudi Arabia, and other states, Tehran has also transferred ballistic missiles to its allies in the region, sharing expertise on their use and installation.

This FOI Memo has been produced as part of a project initiated and funded by the Swedish Ministry for Foreign Affairs. Its objective is to provide an overview of how and to whom Iran has supplied ballistic missiles, along with their associated know-how and technology, in the Middle East. The transfer of Iranian missile technology to other parts of the world is not addressed here. The emphasis is on ballistic missiles, even though other types of weapons systems, such as cruise missiles and long-range drones, may serve a similar strategic function and are being transferred to Iran's allies in a similar manner. Our findings are visualised in a map on page 10. The memo was completed prior to the eruption of the Israel-Palestine conflict in October 2023, and it was first published in Swedish (FOI memo 8249).

The authors have relied exclusively on open sources; the unfavourable source situation has been severely limiting. The information available about Iran's missile programme was typically released by either Iran and its allies or by Israel and other anti-Iran actors, often with reference to confidential intelligence sources. Both sides strive to manipulate the information landscape. The competing narratives do, however, agree on certain points; moreover, some claims are backed up by compelling evidence, such as satellite images and confiscated material. In the case of Yemen, more information is available due to the review work carried out by a UN expert panel established by Security Council Resolution 2140 (2014) and due to the seizing of several shipments of contraband.

Iran's missile programme

Iran's military thinking is shaped by its experiences in the 1980–89 war with Iraq. Its commitment to developing its own ballistic missiles is a consequence of the fact that, at the time, Iran lacked the ability to respond to Iraqi missile strikes. Despite being under sanctions, Iran received clandestine material support from a number of nations. Syria contributed by supplying Scud missiles and training a small group of Iranians on its territory. Libya also sent Scud missiles, launchers and instructors to Iran. The Libyan aid, however, came to an abrupt halt when an Iranian error allowed Iraq to determine that the missiles came from Libya, prompting the Libyans to destroy the equipment they had brought and return home. Nonetheless, Iran managed to reverse engineer some of the damaged equipment.⁽²⁾ Iran's missile capabilities were then further bolstered by North Korean Scud deliveries.⁽³⁾

At the end of the war, a strong conviction emerged that Iran's ability to create a credible deterrent would require it to be self-sufficient in missile technology. Iran's armed forces had been weakened, and the termination of its defence alliance with the United States after 1979 hampered military reconstruction and development. To compensate for the deficiencies in its armed forces, such as its antiquated air force, Iran built asymmetric capabilities. In that regard, too, the missile programme proved invaluable.

Today, the missile programme constitutes a cornerstone of Iranian military strategy. Although Iran's military doctrine is not publicly available, it is commonly described as an offence-oriented "forward defence."⁽⁴⁾ The concept, which has evolved over time, safeguards Iran's national security by combining a potent deterrent capability (Persian: *bazdarandegi*) with the establishment of strategic depth (Persian: *omgh-e rabbordi*) beyond the country's borders.

Table 1. Ballistic missiles named in the text.

Name	User	Fuel	Range	Payload
Fateh A-110 (Iran) M-600 Tishrin (Syria)	Iran, Syria, Hezbollah, Iraqi militias	Solid	210 km	450–500 kg
Zolfaghar	Iran, Iraqi militias	Solid	700 km	500 kg
Scud-B (Soviet Union) Hwasong-5 (North Korea) Shahab-1 (Iran)	Iran, Syria, Houthis	Liquid	300 km	987 kg
Scud-C (Soviet Union) Hwasong-6 (North Korea) Shahab-2 (Iran)	Iran, Syria, Houthis	Liquid	500 km	770 kg
Scud-D (Soviet Union) Hwasong-7 (North Korea)	Syria	Liquid	700 km	500 kg
Qiam-1	Iran	Liquid	700–800 km	750 kg
Burkan-1	Houthis	Liquid	800 km	500 kg
Burkan-2H	Houthis	Liquid	900 km	?
Burkan-3/Zulfiqar	Houthis	Liquid	1,200 km	?

Source: Evestedt 2018; Janes Weapons: Strategic Yearbook 21/22 (ISBN: 978-0-7106-3365-1).

Iran's deterrence posture is primarily aimed at the United States, Israel, and Gulf states such as Saudi Arabia and the United Arab Emirates, as well as, historically and in the long-term, Iraq. Because Iran's leadership believes the country is surrounded by enemies, it has focused on building a politico-military network of allies and client groups, which calls itself "the Axis of Resistance" (Persian: *mehvar-e moghavemat*; Arabic: *mihwar al-muqawama*).⁽⁵⁾ The key player is a branch of Iran's armed forces, the Islamic Revolutionary Guard Corps (IRGC; Persian: *sepah-e pasdaran-e enghelab eslami*), and especially its foreign operations arm, the Qods Force (also called the Jerusalem Force; Persian: *niruy-e qods*). The Axis of Resistance is usually considered as also including the Syrian government, the Yemeni Houthis movement, and a number of armed groups in Iraq (e.g., the Imam Ali battalions), Lebanon (e.g., Hezbollah) and Palestine (e.g., Hamas). The wars in Syria, Iraq and Yemen, as well as other developments in the Middle East in the past decade, have increased Iran's influence but also heightened tensions with its enemies.

The missile programme is used not only to deter Israel and others from attacking Iranian territory directly, but also to bring members of the Axis of Resistance closer to Iran. An Iranian government think tank, the Center for Strategic Research (Persian: *pazhuhesh-kade taghizat-e rahbordi-ye majma' tashkhis maslahat-e nezam*), which is the research arm of the government's Expediency Discernment Council, has also pointed out that arms exports could become an important source

of income. The extent of Iran's revenue from military equipment exports is secret, given that most of its customers, as well as Iran itself, are sanctioned by the United States and Europe.⁽⁶⁾ According to the state-run Islamic Republic News Agency, however, Iran tripled its arms exports in 2022, possibly due to sales of defence equipment to Russia.⁽⁷⁾

According to the IRGC-linked Tasnim News Agency, Iran has now succeeded in creating a regional network of allies who not only have access to its drones but, in some cases, are also producing them. The next goal is to repeat that success by establishing an integrated network of allies with access to missile technology. Tasnim also notes, with a wink to the reader, that several of the country's regional allies already have access to ballistic missiles similar to those developed by Iran.⁽⁸⁾

In a report published by the International Institute for Strategic Studies, Fabian Hinz outlines four methods with which Iran proliferates its weapons technology:

- direct transfer of ready-to-use weapons to an allied actor;
- in situ upgrading of an actor's existing weapons;
- transfer of local manufacturing capability to an actor;
- support for technology transfer by or through a third party or parties.⁽⁹⁾

In practice, these methods overlap, and there may be several approaches to providing technology to the same recipient. The following sections summarise the available information on Iran's transfers of ballistic missiles and related technology throughout the Middle East.

Iraq: Shia militias in the service of Iran

Iran wields considerable influence in Iraq. Since the toppling of Saddam Hussein's regime in 2003, the Iraqi state apparatus has been weak and intertwined with militia organisations that evade central government control. Since 2014, the country's predominately Shia Muslim militia forces have been gathered under the People's Mobilisation Forces (Arabic: *al-hashd al-shaabi*), a state umbrella organisation. Despite formally being part of Iraq's armed forces, receiving federal funding, and being active in Iraq's parliament, state apparatus, and security sector, several of the most powerful groups are de facto subordinate to the IRGC. These factions include, for example, all or parts of the movements that call themselves the Imam Ali Battalions, Hezbollah al-Nujaba, the Badr Organisation, and Kataeb Hezbollah.⁽¹⁰⁾

Based on interviews with Iranian, Iraqi, and Western sources, Reuters reported in August 2018 that Iran had trained and supplied some of these client militias with ballistic missiles. The IRGC were said to have smuggled three advanced weapons systems into Iraq: the Zelzal long-range artillery rocket; the Fateh-110 tactical ballistic missile, developed from Zelzal; as well as the Fateh-110's successor, the Zolfaghar short-range ballistic missile system.⁽¹¹⁾ Only "a couple of dozen" missiles were delivered, according to Iranian sources, but more were ready to be shipped if needed. This information became public shortly after then US President Donald Trump unilaterally withdrew from the JCPOA agreement on nuclear technology and sanctions relief negotiated with Iran, at a time when both sides attempted to increase pressure on each other. According to Reuters's Iranian sources, the missile transfer was part of Iran's effort to develop new deterrents against the United States and its allies. For example, with an estimated range of 700 km, the Zolfaghar system can strike both Riyadh and Tel Aviv from Iraqi territory.⁽¹²⁾

According to Reuters, Iran had already decided to establish local manufacturing in Iraq around the turn of 2016–17, but the plans could not be realised until the first half of 2018. The purported production sites included a facility in Jurf al-Sakhr, southwest of Baghdad; an unidentified location in the Kurdistan region of northern Iraq; and an old Saddam-era missile factory in Zaafraniyah, eastern Baghdad.

In the summer of 2019, reports emerged of unexplained air strikes in Iraq, including on Badr Organisation bases north of Baghdad.⁽¹³⁾ Saudi media claimed they were Israeli attacks against missiles and launchers that had recently been smuggled in, as well as workshops. There were allegedly deaths and injuries among Lebanese and Iranians.⁽¹⁴⁾ More such reports followed, but many details were difficult to confirm.⁽¹⁵⁾ The United States declared in March 2020 that, in response to Kataeb Hezbollah's attacks on US forces in Iraq, it had struck "advanced conventional weapons" supplied to the militia by Iran. A rocket-fuel factory in Jurf al-Sakhr was one of the reported targets.⁽¹⁶⁾

Because Iraq and Iran share a 1,600-km land border, it is natural to assume that Iranian-Iraqi smuggling is primarily accomplished via road transport. In 2019, the Saudi television network al-Arabiya reported that missiles attacked by Israel had been brought into Iraq in refrigerated trucks normally used to transport frozen food.⁽¹⁷⁾ By year's end, the United States claimed that Iran had persisted in deploying missiles into Iraq, assisted by militias that controlled "roads, bridges, and transportation infrastructure in Iraq."⁽¹⁸⁾

Lebanon and Syria: Cat-and-mouse with Israel

Iran has long invested substantial resources in supporting the government of Syrian president Bashar al-Assad and the Hezbollah guerilla in Lebanon, both of whom also collaborate with each other. Syria has been an ally of Iran since the 1980s. During the civil war that erupted in Syria in 2011, Iran has contributed to the defence of Assad's regime by providing fighting forces and recruiting volunteers from the IRGC's international network. Hezbollah is the leading faction in this network. The organisation was founded with IRGC support in the 1980s to oppose Israel's occupation of southern Lebanon. Hezbollah has remained consistently loyal to Iran, even as it has grown to be a significant force in Lebanese politics. It now also operates in Syria, where it works closely with the Assad regime.⁽¹⁹⁾ Given that Syria and Lebanon are so closely interlinked, they are treated together in this text.

From Iran's perspective, Syria and Lebanon offer geographic forward positions that enables it to threaten and thus deter its militarily superior archenemy, Israel. Tel Aviv is only about 200 km from Beirut and Damascus, while Israel's third largest city, Haifa, is a mere 25 km from the Lebanese border. Because of the short distances, the mass firing of simple, unguided artillery rockets poses a credible threat to parts of northern Israel. The additional deployment of long-range,

precision-guided weaponry exposes a very sizable portion of Israel's territory to targeted strikes, including against critical infrastructure.

Syria possessed ballistic missiles before Iran. During the Iran-Iraq war of 1980–88, Syria began training Iranian personnel in the use of ballistic missiles and is thought to have transferred a dozen Scud-Bs to Iran.⁽²⁰⁾ As Iran developed its own missile programme, the flow reversed. IRGC leaders now brag that, despite Syria's being the country that initially introduced Iran to missile technology, it was Iran that eventually expanded Syria's domestic manufacturing capabilities.⁽²¹⁾ On the Syrian side, the project was run by the Scientific Studies and Research Center (SSRC)*, an institution under the Ministry of Defence. Hinz believes that, in the 1990s, Iran likely assisted Syria in developing a domestic solid-fuel production capability. In the early 2000s, Syria was thought to have developed the capacity to produce its own copies of Scud-C and Scud-D.⁽²²⁾ Syria unveiled a domestically-made copy of Iran's solid-propellant Fateh-110A, which it dubbed the M-600 Tishrin, in 2012.⁽²³⁾

Iran, assisted by Syria, has helped Hezbollah accumulate a vast rocket arsenal. It has also contributed ballistic missiles, on a smaller scale. In November 2014, Hezbollah confirmed that it was in possession of the Fateh-110.⁽²⁴⁾ According to later reports, Fateh-110 missiles were surreptitiously provided to the group already in 2006. If so, it was likely in response to Israel's invasion of Lebanon that year.⁽²⁵⁾ An Israeli think tank claims that Hezbollah now has "several dozen" missiles, or "possibly over 100," but it is unclear what the source for these estimates is.⁽²⁶⁾ In 2015, Hezbollah Secretary-General Hassan Nasrallah asserted that the Fateh-110 seemed "old" in comparison to the weapons then in the group's possession.⁽²⁷⁾ There is no evidence available, however, that Hezbollah has received any ballistic missiles other than the Fateh-110/M-600. Although Israeli and American sources claimed in 2010 and 2014 that the group had received both Scud-C and Scud-D missiles from Syria, these allegations remain unconfirmed.⁽²⁸⁾

According to the *Israel Hayom* newspaper, Israeli authorities assume that Hezbollah could currently carry out 6,000 firings per day in the early stages of a war and thereafter maintain a steady 1,500–2,000 daily firings. These numbers primarily relate to unguided rockets, but officials are worried that precision-guided missile and drone strikes on critical infrastructure might "paralyze the country" and, in conjunction with internal instability, harm "the ability of the state to function."⁽²⁹⁾

Smuggling, counter-measures, and retaliation

The Syrian civil war, which began in 2011, has expanded Iran and Hezbollah's influence in the country, while also opening its airspace to Israeli air operations. It has fanned a persistent low-level conflict involving Israel, in particular, but also the United States, which has had troops and aircraft in eastern Syria since 2014; both seek to prevent the import of advanced weapons technology. This has evolved into a violent game of cat-and-mouse that plays out over a significant portion of the Middle East.

The Israeli military claims that, in 2013, Iran started supplying Hezbollah with precision weaponry via Syria. Beginning that same year, Israel conducted airstrikes within Syria that were said to have had a significant impact.⁽³⁰⁾ According to press reports, Fateh-110 missiles in storage at Damascus International Airport were one of the initial targets.⁽³¹⁾ In 2017, the Israeli military was given an extended mandate to strike Iranian interests in Syria more broadly, which resulted in a sharp rise in the number of attacks.⁽³²⁾ As a rule, Israel refrains from commenting on or taking responsibility for individual operations, but exceptions do arise.⁽³³⁾

Iran has occasionally made an effort to retaliate after Israeli attacks, such as after the killing of senior IRGC officers. In some cases, the response appears to have been delivered outside Syria, for example when an oil tanker off Oman was attacked in 2021.⁽³⁴⁾ In the same year, Iranian-backed militias publicly adopted a policy of attacking US troops in Syria, usually with rocket fire, in retaliation for Israeli attacks. Although their motivations are murky, US forces present a much easier target, and Iran's intention also seems to be to incentivise Washington to demand Israeli restraint.⁽³⁵⁾ Although Israeli air strikes inside Lebanon occasionally occur, they are more rare, as Hezbollah's stockpile of rockets and missiles has created a delicate system of mutual deterrence along the border.

Land transport via Iraq

Iraq serves as a transit country for Iranian arms deliveries to Lebanon and Syria, since all three countries are under the influence of pro-Iranian forces. Both the United States and Israel have, however, attempted to counter this by military means. In 2016, as part of the campaign against the Islamic State, the United States seized control of the Syrian-Iraqi border crossing at al-Tanf. Seven years later, American troops remain at al-Tanf, severing the roadway between Damascus and

* Arabic: *markaz al-dirasat wal-buhouth al-ilmiya*; French: *Centre d'études et de recherches scientifiques*, CERS.

Baghdad. This not only damages Syria economically, but also prohibits Iran and its allies from using the route for military objectives.

Iran has access to another border crossing, however, between al-Qaim (Iraq) and Albu-Kamal (Syria). After retaking the area from the Islamic State, the Iraqi and Syrian governments opened the crossing again in the autumn of 2019. Shia militias sympathetic to Iran are still present on both sides of the border, most likely in part to secure the logistics of smuggling. Trucks and warehouses in Albu-Kamal have been routinely targeted by air and drone attacks in recent years. It is unusual for anybody to admit responsibility, but the strikes are almost certainly the work of Israel and possibly also of the United States. Although Iran-friendly media portray the strikes as attacks on aid convoys, several sources claim that Iran and its allies have used aid shipments as a cover for arms smuggling.⁽³⁶⁾

Air transport via Iraq

The Iranian-directed smuggling activities also rely on military and civilian aviation. According to Israeli military sources, Iran shifted to smuggling minor parts using passenger planes in 2022, after previously relying mostly on cargo aircraft capable of transporting heavy arms shipments.⁽³⁷⁾ Among other things, the IRGC is accused of flying GPS systems directly into Beirut.⁽³⁸⁾ Since the beginning of the Syrian war, the United States has attempted to persuade Iraq to halt, or at least inspect, Iranian flights to Syria, without much success.⁽³⁹⁾ The US Treasury Department has also sanctioned Iranian airlines alleged to be delivering weaponry to Syria and Lebanon or working for the IRGC.⁽⁴⁰⁾

Furthermore, a substantial number of presumably Israeli strikes have been directed against military airfields such as Mezze (Damascus) and Tiyas (central Syria), as well as warehouses near the Damascus and Aleppo airports. The pace has quickened since 2022, and there have been several strikes on Aleppo's and Damascus's civilian aviation infrastructure. This has sparked criticism, as damage to these airports impedes legitimate civilian traffic, including United Nations relief flights.⁽⁴¹⁾ The escalation, according to intelligence sources who spoke with Reuters, is a response to Iran's increased air deliveries either to or via Syria. That increase is, in turn, said to be the result of strikes on road transports in eastern Syria.⁽⁴²⁾

Sea transport via Suez

According to US and Israeli sources, Iran is also sending military equipment to Syria by sea, in addition to its more extensive tanker transport to supply it with oil. As

a rule, the Iranian vessels involved sail with their automatic identification systems (AIS transponders) turned off to avoid detection, to avoid punitive sanctions or Israeli attacks. Passage through the Suez Canal is nonetheless impossible to conceal.⁽⁴³⁾

For several years, Israel and Iran have attacked each other's ships all the way from the Mediterranean through the Red and Arabian Seas to the Persian Gulf, using mines and drones.⁽⁴⁴⁾ In 2020–21, the Russian Navy, operating from its base in Tartous, Syria, began escorting Iranian tanker vessels in convoys.⁽⁴⁵⁾ Russian state media reported that a trilateral cooperation arrangement with joint operations management was formalised in spring 2021: Iran would safeguard traffic from the Persian Gulf to Suez, while Russian warships would oversee the voyage in the Mediterranean past Israel to Syria.⁽⁴⁶⁾ Russia, in Israel's view, thus also facilitates arms deliveries.⁽⁴⁷⁾ The Syrian container port in Latakia was bombed in the winter of 2021. According to media reports, Iranian cruise missiles or drones were among the targets.⁽⁴⁸⁾ Israel is also accused of attacking at least one vessel alleged to be transporting weapons, despite the fact that the ship was, at that time, escorted by the Russian Navy.⁽⁴⁹⁾

It is unclear whether the tripartite cooperation agreement remains in effect and, if so, how the war against Ukraine and the closure of the Turkish straits for naval traffic in 2022 have affected it.

Local production and conversion in Lebanon

Iran is alleged to have shifted its approach towards the end of 2015, from bringing in arms supplies over Iraq and Syria to delivering disassembled weapons components through a number of channels, including regular land border crossings between Syria and Lebanon, commercial aircraft to Beirut, and ships to the port of Beirut. Israel claims that although Iran and Hezbollah hoped to begin local production in Lebanon in September 2018, the project had proceeded slowly. Iran is said to have stepped up its efforts in 2019.⁽⁵⁰⁾ Hezbollah Secretary-General Hassan Nasrallah claimed in February 2022 that there is no longer a need to import missiles from Iran because Hezbollah has long been able to convert rockets into precision-guided weapons. Nasrallah stated that the group owned "thousands" of such rockets and that "a large number" had already been converted; he also claimed that Hezbollah manufactures drones.⁽⁵¹⁾

It is likely that Hezbollah can manufacture some weapons parts locally, writes Hinz, which means that "only the most sophisticated components" need to be imported or smuggled.⁽⁵²⁾ The GPS add-on kits developed by Iran are small enough to fit inside a small suitcase,

which makes smuggling easier.⁽⁵³⁾ Older artillery rockets can be upgraded to precision-guided missiles with this type of retrofit technology. For example, according to Iranian state media, the Zelzal solid-propellant rocket used by Hezbollah can be converted into a ballistic missile dubbed the Raad-307.⁽⁵⁴⁾

Some bulky and outsize objects must still be transported. An unusual kamikaze drone attack occurred in southern Beirut in the summer of 2019, targeting, according to press reports, an eight-ton industrial mixer intended to manufacture solid fuel for large rockets and missiles.⁽⁵⁵⁾

For obvious reasons, the Iranian-sponsored missile activity in Lebanon appears to be concentrated in Hezbollah-dominated areas. In 2018 and 2019, Israel released satellite imagery purportedly showing conversion activity in two such areas: the Beqaa Valley and the southern suburbs of Beirut.⁽⁵⁶⁾

Manufacturing at SSRC in Syria?

Israel accuses the state-run Syrian research institute SSRC of playing a key role in Iran's efforts to arm Hezbollah. Syria, Iran, and Hezbollah, according to Israeli sources, now use "the same factories for the production of their weapons."⁽⁵⁷⁾

Syria's own missile programme appears to have been damaged early in the war, including by fighting at SSRC facilities in Sfeira, south of Aleppo. The missile programme was probably also undermined when the Organisation for the Prohibition of Chemical Weapons (OPCW) was given a UN mandate to eliminate Syria's chemical weapons arsenal in 2013–14, since the SSRC had overseen both the country's ballistic missile development and its chemical weapons programme; Syria intended to use ballistic missiles to carry chemical warheads.

According to Israeli reports, Iran has since assisted in the rebuilding or relocation of operations from Sfeira to western Syria. In 2018, the Israeli company Image Sat International published satellite images of buildings and tunnels near Banyas and Masyaf that were allegedly similar to Iranian missile factories. The Israeli government has also released a map of a dozen or so alleged SSRC facilities purported to be aiding Iran's efforts. In particular, the installation at Masyaf was identified as a threat and a centre for missile production.⁽⁵⁸⁾

SSRC infrastructure is currently being bombed on a regular basis, while SSRC researchers have been killed in targeted attacks.⁽⁵⁹⁾ Airstrikes against Sfeira's military industries have occurred since around 2020, suggesting that operations have resumed there.⁽⁶⁰⁾ In the autumn of 2022, Israeli officials claimed that their country's focus was now to stop the "smuggling of components" to SSRC

in Masyaf, and that it had destroyed nine tenths of the Iranian infrastructure in Syria and "almost completely" prevented attempts to smuggle in advanced weapons and create local manufacturing capacity.⁽⁶¹⁾ The veracity of these claims is unclear, and open sources do not provide enough information to determine what is truly going on at the attacked SSRC facilities or what role Iran may potentially be playing there.

Palestine: Active smuggling, but no known ballistic missiles

Iran backs several Palestinian armed organisations, such as the Islamist movements Hamas and Islamic Jihad, which have been equipped with long-range artillery rockets and also produce their own rockets.⁽⁶²⁾ Hamas acts as the de facto government in the Gaza Strip, where Islamic Jihad, too, has its power base. Palestinian groups can primarily fire on Israel from the Gaza area, but in April 2023, Hamas is believed to have launched a barrage of rockets from Hezbollah-dominated southern Lebanon.⁽⁶³⁾

The armed groups operating in the Gaza Strip are mainly supplied across the Sinai Peninsula, assisted by Bedouin clans and smugglers. The border is crossed through tunnels, especially in the vicinity of the border town of Rafah. The tunnels are also a crucial conduit for the entry of civilian goods into the besieged Gaza Strip. Iranian arms shipments via Sinai often appear to have first transited Yemen or Sudan, but a deterioration in relations between Tehran and Khartoum in the 2010s has likely made it more difficult for Iranian-Palestinian networks to operate there.⁽⁶⁴⁾ Egypt has also expended great effort to prevent the smuggling of goods between Sinai and Gaza, particularly since a regime change in 2013. In May 2020, the Egyptian military claimed to have destroyed over 3,000 smuggling tunnels.⁽⁶⁵⁾

To some extent, the smuggling of weapons into Gaza also appears to have a maritime component, with small boats and divers operating out of the Sinai or possibly from ships in the Mediterranean.⁽⁶⁶⁾ Israel periodically reports that the Coast Guard and the Navy have sunk or intercepted vessels attempting to reach Gaza.⁽⁶⁷⁾ In March 2014, in the Red Sea, Israeli forces boarded a Panama-flagged cargo ship carrying military equipment, including Syrian-made M-302 rockets, which Israel asserted were destined for Gaza. A UN panel determined that the shipment was on its way to Sudan, although this does not preclude that Gaza may still have been its final destination.⁽⁶⁸⁾

In order to circumvent the blockade of Gaza, Iran appears to have tried to support technology transfer

and enable local rocket production, as it has done in other places.⁽⁶⁹⁾

At the moment, however, there is neither proof, nor even credible allegations, that Iran has handed over ballistic missiles to Palestinian organisations. Even though an IRGC commander affirmed, in 2014, that “resistance groups” – seemingly said in reference to both Hezbollah and Palestinian organisations – could now handle missiles up to the Fateh-class level, his wording was ambiguous.⁽⁷⁰⁾ Nonetheless, Iran and its Palestinian allies could use the arms smuggling networks they have already established to transfer subsystems and modify artillery rockets in the same way as is done in Lebanon.

Yemen: Helping the Houthis build a missile arsenal

Yemen has been embroiled in a bloody civil war for several years. Much of densely populated western Yemen, including Sanaa, is under the control of the Iranian-backed group Ansar Allah, also known as the Houthis. In the spring of 2015, Saudi Arabia and the United Arab Emirates intervened militarily to support the remnants of Yemen’s internationally recognised government, which, alongside allied militias, controls parts of the country’s south and east.⁽⁷¹⁾ There has been relative calm since April 2022, thanks to a UN-mediated ceasefire and negotiations.

During the conflict, the Houthis have repeatedly launched drones and ballistic missiles to attack targets in Saudi Arabia and the United Arab Emirates. Saudi Arabia was the target of the most recent missile attack, in March 2022.⁽⁷²⁾ The Houthi-controlled northern region of Yemen is located just over 800 km from Riyadh, while Abu Dhabi is nearly 1,300 km away.

At the time of writing, no attacks against Israel have been conducted, but the Israeli military warned, in December 2022, that Iran could fire at Israel from Yemen.⁽⁷³⁾ Shortly after, in January 2021, Israeli media disclosed that the Israeli military had relocated air defence batteries (Iron Dome and Patriot) to Eilat, at the southernmost tip of the country, to counter long-range Yemeni attacks.⁽⁷⁴⁾ The distances involved, however, are considerable. Eilat is just over 1,600 km from Houthi-controlled territory, and Tel Aviv more than 1,800 km.

Old and new missiles

Yemen had a stockpile of imported short-range ballistic missiles (Soviet Scud-B and North Korean Scud-C/Hwasong-6) even before the war, but no domestic production. Such missiles subsequently fell into the hands of the Houthis, who, in the course of the war, have

also unveiled several new models. External observers maintain that these new systems exhibit characteristics of Iranian Scud variants, rather than being developed directly from Soviet or North Korean designs.

In 2016, the Houthis demonstrated the short-range ballistic missile Burkan-1, which observers consider to be either an upgrade of the Hwasong-6 or a modified Iranian missile from the so-called Shahab series (both are Scud derivatives). The following year, the rebels presented the Burkan-2H, which the Houthis claim was developed from the Scud-C, although the UN expert panel for Yemen considers it to be “an advanced derivative of Qiam-1,” Iran’s further refinement of the Shahab systems.⁽⁷⁵⁾ Yet another version, Burkan-3, also known as Zulfiqar, was introduced in 2019. Observers believe that it, too, is derived from Qiam-1.⁽⁷⁶⁾

The Houthis themselves assert that all production and development of advanced weaponry is done independently, and Iran denies any military involvement. In April 2021, Brigadier General Rostam Ghasemi, a senior IRGC leader, stated that Iran was sending a limited number of military advisers, and that the Houthi drone and missile arsenal had been developed with Iranian technical assistance, despite being manufactured in Yemen. The Houthis and the Iranian Ministry of Foreign Affairs both swiftly refuted this, but Ghasemi stuck to his word.⁽⁷⁷⁾ Since 2018, the UN Panel of Experts on Yemen assesses that Iran is supporting the Houthi missile programme.⁽⁷⁸⁾

The United States and Britain regularly accuse Iran of smuggling weapons to the Houthis. In 2018, the US Treasury Department placed five IRGC members and one organisation on its sanctions list for providing missile technology to the Houthis.⁽⁷⁹⁾ The United States has also promised a reward of up to \$15 million for information about Abdul-Reza Shahlai, a Qods Force commander based in Sanaa, who is, among other things, suspected of being a major player in the smuggling of weapons to the Houthis.⁽⁸⁰⁾ Media reports state that Shahlai survived a US drone attack in Sanaa at the same time that the United States killed Major General Ghasem Soleimani, the head of the Qods Force, in Baghdad.⁽⁸¹⁾

Iranian smuggling to Yemen

Weapons smuggling to and from Yemen has been going on for years, even before the war, and is made easier by its 2000-kilometre-long coastline. There is ample evidence that military materiel, including missile technology, currently flows along several routes from Iran to Yemen. The strategies are complex, involving shipments by sea, transportation through several countries and the parallel

action of groups of smugglers and fixers in multiple locations. At least three major routes can be identified, all of which involve transshipment by sea, land, or both.⁽⁸²⁾

Firstly, weapons have been delivered directly to Houthi-controlled Red Sea ports via the Gulf of Aden, the Arabian Sea, and the Gulf of Oman. Shipments may be transferred to new vessels in or off the coast of African countries, such as Somalia and Djibouti.

Secondly, a smuggling route runs along the coast of Oman to the south eastern Yemeni provinces of al-Mahra, Hadhramout, and Shabwa, which, on paper, are controlled by groups loyal to the internationally recognised government. Weapons loads appear to be transferred between boats on the Kuria Muria Islands, off Oman's south coast, and from boat to truck in ports in southern Yemen. The loads are then transported to the rebel areas in the northwest.

Thirdly, Iranian weapons are being smuggled across Oman's 288-kilometre land border with Yemen. Much of the border region is sparsely populated, but Houthi-controlled areas are distant and it has its own complicated politics, including Omani influence on the Yemeni side.⁽⁸³⁾ Weapons have been seized at the Shahn border post in recent years. However, in order for Iranian weapons to reach Oman, they must first be transported by boat or air. They then need to be smuggled onward by car, through areas that are formally under Yemeni-government control, in order to reach the Houthis.

There is also evidence that Iranian weapons have previously been shipped to Yemen on commercial cargo vessels from nations not suspected of smuggling arms (Thailand has been mentioned), as well as on civilian flights from Tehran to Sanaa. Additionally, there is speculation about contraband being flown by drone over Yemen's land border with Oman.⁽⁸⁴⁾ The Iranian port city of Bandar-e Jask appears to be an important starting point for arms smuggling. Located on a promontory in the Gulf of Oman, it is the closest Iranian city to Oman (approximately 160 km). Four US and UK arms seizures on boats in 2021–22 revealed, through confessions or the inspection of digital devices, satellite data, or both, that the boats had travelled from Bandar-e Jask.⁽⁸⁵⁾

Some smuggling operations are suspected of using the Kuria Muria Islands, off the southern coast of Oman, as a transfer point. The US Navy seized two boats carrying Iranian weapons, including cruise missile components, in November 2019 and February 2020. GPS devices found on board revealed that one boat had departed from the Yemeni port cities of al-Mukalla and al-Shihir, and the other from al-Ghaydah, in the

country's southeast, near the border with Oman. Both boats proceeded to the Kuria Muria Islands, where they most likely took on board the weapons that were subsequently seized on their voyage back to Yemen.⁽⁸⁶⁾

Seized arms shipments

Since 2018, the United States, the United Kingdom, Australia and Saudi Arabia have boarded at least 15–20 high speed motorboats and dhows (traditional fishing boats) carrying weapons suspected of being of Iranian origin. Boardings have occurred along the maritime smuggling routes that connect Iran and Yemen, through the Gulfs of Aden and Oman, and the Arabian Sea. Many different types of weapons were discovered in the seizures, including basic firearms, machine guns, rocket-propelled grenade launchers, and recoilless anti-armour guns, as well as weapons that Iran imported from China or Belarus. At least four times since 2019, the United States and its allies have claimed to have boarded vessels of Iranian origin carrying missile components or rocket fuel. In two of those cases, the United States claimed to have seized ballistic missile parts:

- An American destroyer, the USS *Forrest Sherman*, intercepted a dhow in the Gulf of Aden on 25 November 2019. Found on board were Iranian anti-tank missiles, surface-to-air missiles, drones and parts of the Chinese-designed C-802 anti-ship missile, as well as components of the Iranian Qods-1 cruise missile.⁽⁸⁷⁾
- On 25 February 2022, personnel from a British frigate in the Gulf of Oman boarded a high-speed motorboat on its way from the Iranian coast. On board were engines for the Qods cruise missile series as well as a Chinese mini-drone, whose flight log showed that it had been tested at IRGC facilities in Tehran.⁽⁸⁸⁾
- Two ships of the US Fifth Fleet intercepted a Yemeni crewed dhow on 7 November 2022. Its cargo included 100 tonnes of urea, a nitrogen-based fertiliser that can be used as an explosive, and 65–70 tonnes of ammonium perchlorate, which is used, among other things, to make explosives and fuel for both rockets and missiles. According to Vice Admiral Brad Cooper, Commander of the Fifth Fleet, this quantity of ammonium perchlorate could be “enough to fuel more than a dozen medium-range ballistic missiles depending on the size.”⁽⁸⁹⁾

- On 25 February 2023, British marines boarded a high-speed motorboat in the Gulf of Oman and discovered that its cargo included ballistic missile components. It also included anti-tank missiles used by the Houthis, supporting the theory that Yemen was the ship's final destination.⁽⁹⁰⁾

Domestic missile production in Sanaa

There is evidence that Iran has attempted to establish local production or assembly capabilities in Yemen, but the information is typically difficult to evaluate and the sources are often biased. According to anti-Houthi Yemeni and Israeli ministers, as well as Arab and Israeli newspapers and military blogs, there is at least one and possibly more missile factories near Sanaa, and the Houthis are aided by experts from Iran and Lebanese Hezbollah. There are also indications that Israel acted militarily against Yemeni missile manufacturers in 2022.

In December 2020, Brigadier General Hidai Zilberman, a spokesman for the Israeli Defence Forces, stated that the possibility of Iran's attacking Israel from Yemen was not ruled out, claiming that Tehran is developing "smart missiles" and drones in Yemen.⁽⁹¹⁾

Yemen's information minister, Moammar el-Eryani, tweeted at the end of July 2022 that a ballistic missile had exploded in a workshop near the Sanaa airport, where, according to him, missiles and drones were being manufactured. Eryani claimed that five engineers, including foreign nationals, perished in the explosion.⁽⁹²⁾ On 8 August 2022, more than a week later, the Saudi television channel al-Arabiya reported that six Iranian and Lebanese experts, as well as dozens of Houthis, had been killed in two explosions as a ballistic missile was about to be installed. The incident was said to have caused another explosion in a factory and a weapons warehouse at the al-Hafa military base, in eastern Sanaa.⁽⁹³⁾ Aviv Kochavi, the then head of the Israeli military, stated on 18 August that Israel had acted in a "third country" ten days earlier, concurrently with a military operation in Gaza that took place 5–7 August. This coincides with the reports of explosions at the al-Hafa base in Yemen.⁽⁹⁴⁾ A few weeks later, the Israeli defence minister at the time, Benny Gantz, stated that "the Iranians are currently working to build missile and weapon industries in Lebanon and Yemen."⁽⁹⁵⁾

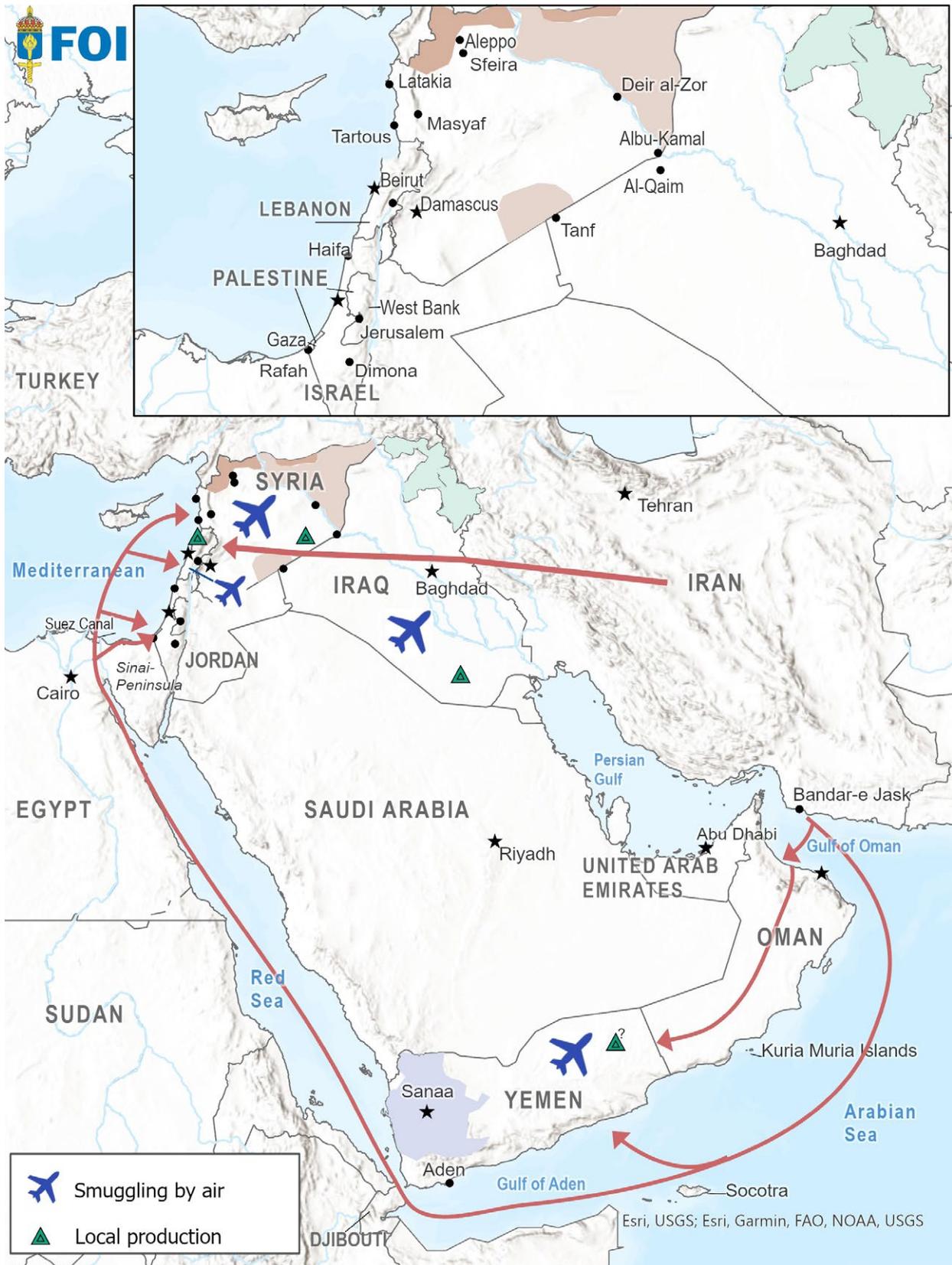
Conclusions

For many years, Iran has supplied ballistic missiles and related technology to Middle Eastern allies. The goal is to strengthen Tehran's regional position and deterrence capability, particularly against Israel and the United States, but also against Arab states. All recipients are highly Iran-friendly, and some of them are outright client groups. Iran is likely to be able to control or influence how the recipients use the technology in some way, such as by having its own personnel in place.

It is difficult to predict how, and how far, these proliferation efforts have progressed. The situation regarding sources is poor, not because there is a lack of information, per se, but because the information is primarily being disseminated in the context of a propaganda war between Iran, Israel, the United States and other actors. On the Iranian side, the IRGC, and particularly its foreign operations branch, the Qods Force, appears to play a key role. It seems clear that the Syrian government, Yemen's Houthis, and some Shia militants in Iraq possess Iranian-developed missiles. To date, no reliable information has emerged in open sources indicating that Palestinian groups have been armed with ballistic missiles.

The methods of proliferation differ from one region to the next. Iraq can be accessed by Iran directly across its land border, whereas Yemen is mostly accessible by sea. Syria is reached via Iraq, and Lebanon through Syria. Smugglers' tunnels from Egypt connect to Gaza. Missiles can be disassembled into their component parts, which are then moved separately, before being reassembled in situ. Some components can be produced locally. Smaller components (for example, some electronics) are easy to conceal and move on passenger flights and other modes of personal travel.

Iran has supported its allies in setting up an infrastructure for local assembly and manufacturing in order to reduce risks and increase deniability. Since Iran has previously assisted in establishing local production of artillery rockets in Gaza and Lebanon, and similar conditions surely exist in Syria and possibly in Yemen, converting rockets into ballistic missiles is a simple way to reduce the risks and the need for smuggling. Hezbollah in Lebanon, in particular, appears to have been successful in upgrading already available rockets with GPS navigation and guidance systems. ■



Map 1. Middle Eastern proliferation of missile technology from Iran

Highlighted areas: Kurdistan (Iraq); Turkey-supported groups (Syria); US-supported groups (Syria); Houthis (Yemen)

Source: Marianna Serveta, FOI

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