

BICOM Briefing

Hezbollah's Precision Missile Project

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CONTENTS

Executive Summary	1
Introduction	2

PART ONE: WHAT IS HEZBOLLAH'S PRECISION PROJECT

What is Hezbollah's 'Precision Project' and why is it a game changer?	3
How do GPS precision guided missiles work?	4
What does the upgrading process involve?	5
How many precision missiles does Hezbollah currently have?	7
What threat do precision missiles pose?	8
The regional threat of Iranian precision guided technology	10

PART TWO: ISRAEL'S RESPONSE TO THE PRECISION MISSILE THREAT

How has Israel targeted arms convoys and factories in Syria?	10
Why has Israel used public intelligence revelations to address precision missile facilities in Lebanon?	11
Does Israel have the option of a pre-emptive strike inside Lebanon?	12
How effective are Israeli missile defences?	13
What is the significance of the IDF's new 'missile corps'?	13
Does Israel have the capability for jamming or spoofing of GPS guidance?	13

APPENDIX

Iranian precision technology: A comparison	14
How much does the Precision Project cost?	14

EXECUTIVE SUMMARY

- In February 2019 BICOM produced this paper that examines Hezbollah's precision missile project in Lebanon. This revised edition is updated to include events in August 2019 when Israel reportedly destroyed Hezbollah equipment in Beirut that was part of its missile development programme and reports that Israeli forces have attacked Iranian missiles stored by Shia militias in Iraq.
- European countries have been critical of Iranian missile tests but a more urgent and alarming regional threat is Iran's project to upgrade Hezbollah missiles into precision guided missiles. These would enable the Lebanese group to accurately target critical Israeli infrastructure and constitutes a significant threat to Israel's security.
- The Hezbollah Precision Missile project is a test case that could be replicated. After infrastructure has been put in place, evidence suggests that missiles can be converted into precision guided missiles in just a few hours at a cost of \$5,000- \$10,000. Iran has already attempted to utilise this technology for its Houthi allies in Yemen, a move which could put US bases in the Gulf under significant risk.
- Iran sought originally to deliver advanced precision missiles to Hezbollah in Lebanon via Syria, with these efforts intensifying during the Syrian civil war. Israel declared that the supply of such weapons was a 'red-line' and has carried out air strikes to prevent them reaching Hezbollah by targeting storage facilities, weapons convoys, and research and production facilities in Syria.
- As a result, Iran launched a new initiative to fit GPS guidance packs onto 'dumb' medium range Zelzal 2 missiles, of which Hezbollah is thought to possess 14,000 and which are already located in Lebanon. Once in the factory, an existing section of the Zelzal 2 is removed and replaced with a new section which includes a GPS-type navigation system; a command and guidance system; and a control system (for applying guidance commands and steering the missile). This transforms the Zelzal 2 into something similar to a Fateh 110 missile. Relevant components are transported from Iran to factories in Syria and Lebanon, either by land, or by air via Damascus, using civilian aircraft.
- Iraq has emerged as both an overland transit point for missile components (Iran-Iraq-Syria-Lebanon) as well as a potential future launching pad for strikes on Israel, with Iran believed to be arming Shia militias in Iraq (Popular Mobilisation Units) with such weapons systems. By September 2019 Israel had confirmed attacking inside Iraq, likely including PMU bases and convoys. [Reports](#) from August 2018 said that Iran had started to deliver ballistic missiles to its Shia proxies in Iraq.
- It is not clear how many precision missiles Hezbollah currently has, with estimates ranging from the low 20 to 200. But even a small number of missiles could do serious damage to Israel – which is a small, densely populated country with all its key industrial and critical infrastructure sites concentrated in a small number of locations. Hezbollah has already threatened to attack power stations, air force bases, the Haifa oil refinery, the nuclear reactor close to Dimona, and the 'Kirya' Ministry of Defence and IDF Headquarters in central Tel Aviv.
- Israel has been developing missile defence systems since the 1980s. Yet whilst the country's capabilities are arguably the most comprehensive and capable in the world, they cannot provide hermetic protection. And with limited batteries available, Israel may be forced to make a choice between protecting critical infrastructure or population centres.
- Israeli decision makers have faced a dilemma over how best to counter Hezbollah's Precision Missile Project. Israel could launch pre-emptive strikes inside Lebanon to destroy missile factories, but those could trigger a wider conflagration with Hezbollah. Thus, Israel initially used public warnings and select intelligence leaks to warn Hezbollah and the Government of Lebanon about the dangers of pursuing the project. By mid-2019 Israel saw an expansion of

What is Hezbollah?

Hezbollah is an armed Shia movement founded in Lebanon in 1982. It was established with the help of Iran and remains closely allied and ideologically committed to the Iranian regime. With its substantial independent armed forces – estimated at 45,000 fighters – and political base in Hezbollah's Shia community, it is a key political player within Lebanon. In May 2018 Hezbollah and its political allies won 70 of Lebanon's 128 parliamentary seats in the country's first parliamentary elections since 2009 and Hezbollah allies now hold two ministerial positions and a ministry of state in the government. Hezbollah – like Iran – is ideologically committed to Israel's destruction, and gains domestic and regional legitimacy by positioning itself as part of the 'resistance' against Israel. This is despite Israel withdrawing all military forces from south Lebanon in 2000.

Hezbollah has played a significant role fighting in support of the Assad regime in the Syrian civil war and played a major role in the battles for Aleppo, the Qalamoun region and the towns of Zabadani and Qusayr near the Lebanese border.

What happened in the 2006 Second Lebanon War?

In July 2006, a Hezbollah raid into northern Israel – which resulted in eight Israeli soldiers killed and two captured – triggered a 34-day conflict between Hezbollah and Israel. Hezbollah fired 4,000 missiles at northern Israel, whilst Israel – which was yet to develop a missile defence system – used air and ground forces to try and destroy the launchers. Forty-six Israeli civilians were killed and the Israel Defence Forces (IDF) lost 121 soldiers. One thousand two hundred Lebanese were killed, the IDF estimates that 600-800 were Hezbollah fighters. The war ended with a UN-backed ceasefire, which mandated a strengthened UN force and required the Lebanese Armed Forces to deploy on the border in place of Hezbollah. However, whilst a ceasefire has mostly held since 2006, Hezbollah has not been prevented from greatly strengthening its military capabilities and deploying forces along the border with Israel.

What threat do Hezbollah's current capabilities pose?

Hezbollah possesses approximately 100,000 to 130,000 missiles, many hidden in houses and civilian infrastructure in the villages in Hezbollah-dominated areas of southern Lebanon. Fourteen thousand are [estimated](#) to be Zelzal 2 missiles with a range of 210km. Whereas in 2006 Hezbollah fired an average of 118 missiles a day, it is estimated that it could now fire at least 1,200. Even with Israel's early warning and missile interception system, missiles fired at major population centres in large numbers can be deadly, forcing civilian populations to remain in or near shelters, closing schools and businesses, and paralysing normal life.

Hezbollah has also developed plans for cross border raids using tunnels, six of which have recently been uncovered inside Israeli territory and destroyed in an IDF operation in late 2018. It is unclear if any tunnels remain operational or whether Hezbollah will continue with this strategy.

Iran's attempts to [establish Shia proxies in Syria](#) to complement the Hezbollah force in Lebanon with a second front, also faced a major setback in 2018. Israel launched a successful wave of airstrikes against these bases, culminating in Operation House of Cards in May 2018 in which the IAF hit Iranian targets throughout Syria.

the project inside Lebanon and, as a result, increased the scope of its public warnings and reportedly launched a drone strike against high-value missile components in Beirut. Hezbollah's limited response to the drone strike was calculated not to escalate the situation further and cause a major round of fighting.

- The US and key European states including the UK, France and Germany can play an important role preventing an escalation in Lebanon. One option would be to publicly warn Hezbollah and the Lebanese Government that they are aware of the precision project and to make clear that the project is a direct violation of UN Security Council Resolution 1701. If these warnings fail to make an impact then they should consider initiating tough sanctions against those involved in the project from Hezbollah and the IRGC.

INTRODUCTION

- This briefing reveals how Hezbollah, with the help of Iran, is upgrading its arsenal, to convert its missiles into precision missiles with guidance systems and greatly increase its ability to destroy Israel's military and civilian infrastructure. Israel has been warning since 2006 that Hezbollah has massively increased its stockpile of short and medium range missiles. Yet Hezbollah's attempts to acquire precision-guided medium range missiles present a much more serious threat.

PART ONE: WHAT IS HEZBOLLAH'S PRECISION PROJECT AND WHY IS IT A GAME CHANGER?

- Hezbollah's 'Precision Project' refers to attempts by Iran to upgrade Hezbollah's large arsenal of missiles by improving their accuracy. Commanders of the Iranian Revolutionary Guards Corps (IRGC) and Hezbollah have [boasted publicly](#) about it.
- Precision-guided missiles present a far greater strategic threat than unguided missiles previously deployed by Hezbollah, because they can target key Israeli infrastructure with fewer missiles. Because of Israel's size and concentrated population and industry, damage to a small number of

key infrastructure sites – e.g. power stations, military bases, and Ben Gurion International Airport – could have severe consequences. The more accurate the missiles, the fewer are required to get through Israel's missile defences in order to damage or destroy the target.

- In the 2006 Second Lebanon War, Hezbollah only fired short range missiles without precision guidance systems. Whilst 46 civilians were killed in northern Israel, and significant damage was caused, most missiles hit open areas, and no major strategic targets were hit. Israel was able to sustain the barrage for 34 days of the conflict. Since then, Israel has expanded its missile interception capability, including deploying Iron Dome to intercept missiles in the 7-40km range.
- Following the 2006 war Hezbollah greatly expanded the size and range of its missile arsenal. Israeli intelligence sources believe Hezbollah now has 100,000 to 130,000 missiles, including approximately 14,000 Zelzal 2 and Scud missiles with a range of 200km to 400km.
- Iran has attempted to equip Hezbollah with advanced precision guided missiles in direct violation of UN Security Council Resolution 1701, which ended the Second Lebanon War in 2006 war and which mandated "no sales or supply of arms and related materiel to Lebanon except as authorised by its Government." Israeli media cited defence officials in 2010 [reporting](#) that Hezbollah had acquired M-600 missiles from Syria (the M-600, or "Tishreen," is a Syrian version of

HOW IS PRECISION MEASURED?

Precision missiles are defined as those possessing low Circular Error Probability (CEP). CEP is defined as the radius of a circle whose boundary is expected to include the landing points of 50 per cent of missiles fired. For example, if a given missile has a CEP of 10m – a range Iran has aimed for but has not achieved – half of those fired will fall within 10m of the intended target. The lower the CEP, the fewer the missiles required to destroy a target.

Hezbollah's missiles

Type	Range
107MM Rocket	8-10km
Type-81	20.5km
Falaq-1	10/11km
Shahin-1	13km
Katyusha	4-40km
Fajr-3	43km
Fajr-5	75km
Khaibar-1	100km
Zelzal 2	210km
Fateh-110	300km
Scud-B/C	500km

Total: 100,000-130,000 missiles of which 14,000 are Zelzal 2



the Iranian GPS-guided Fateh-110). In 2014, [Iranian commanders](#) openly stated that they had provided Hezbollah with Fateh-110s, a claim echoed by Hezbollah leader [Hassan Nasrallah](#) in January 2015. Efforts to deliver advanced missiles in full from Iran to Hezbollah in Lebanon, via Syria, intensified during the Syrian civil war, in which Iran gained much greater scope to operate in and through the country. Israel on the whole thwarted these efforts in the 2013-2015 period, preventing most of the weapons getting through, but in [September 2018](#) Nasrallah claimed Israel's efforts had failed. "I tell [Israel] no matter what it did to cut the route, it is over. It has already been achieved. Hezbollah now possesses precision missiles and non-precision weapons capabilities."

- Nevertheless, as of August 2019, Israel stated that Iran had struggled to realise its vision for the program despite intense efforts. Due to Israeli actions in Syria,

the scope of Iran's efforts had shifted to Lebanon, escalating its attempts to smuggle in missile components and establishing more production facilities.

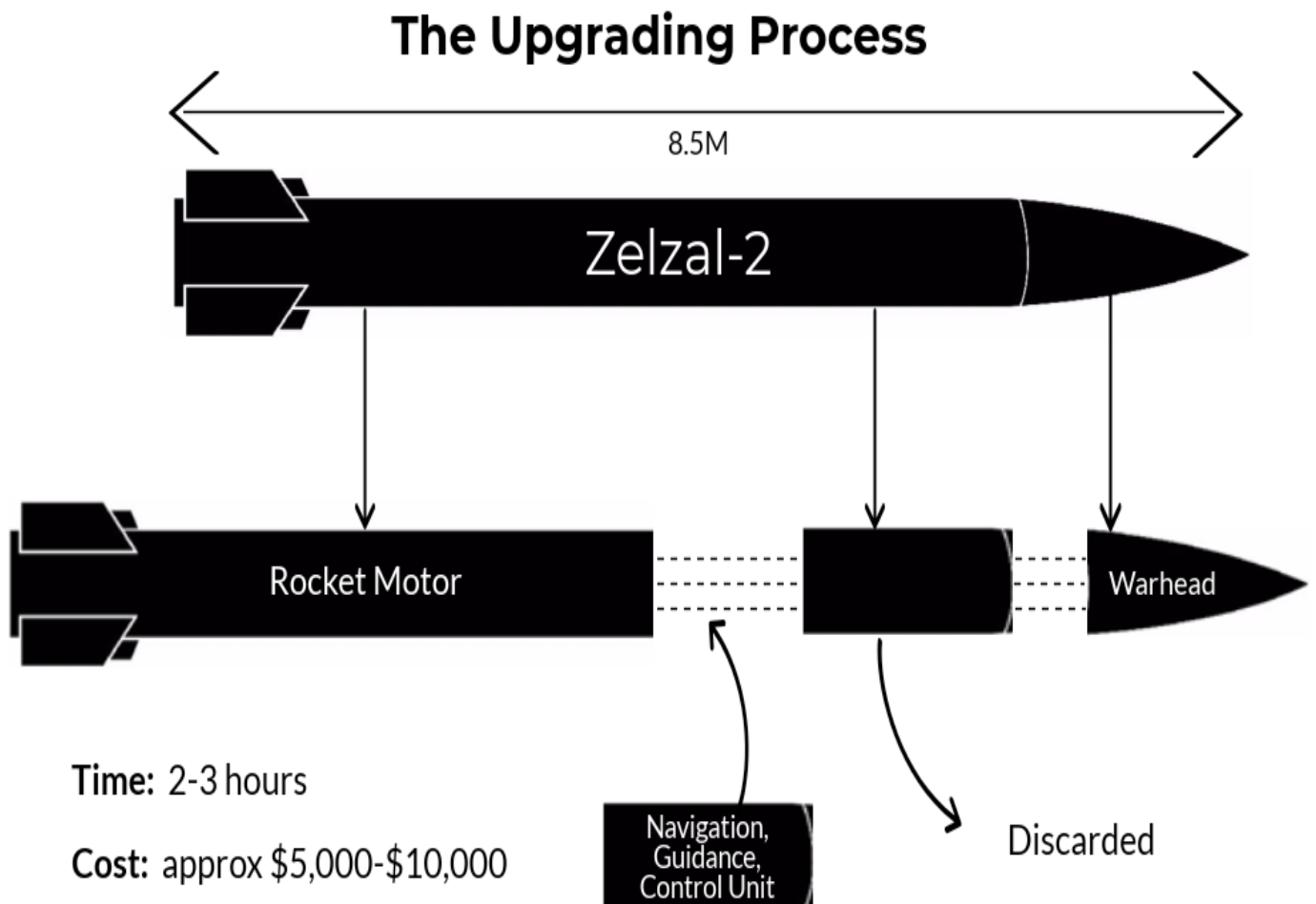
- [Iran is now engaged in an extensive project to fit GPS guidance systems onto 'dumb' missiles already in Lebanon](#), as an alternative to transferring entire missiles from Iran. This shift in strategy began in 2016 and intensified in 2019, especially the smuggling of missile components (including GPS kits) and the establishment of production facilities inside Lebanon. In September 2018, speaking at a counter terrorism conference, former Mossad deputy chief Naftali Granot admitted that Hezbollah had "recently received small numbers of GPS precision-guided systems that will help it to convert some heavy missiles into accurate missiles". According to Israeli assessments, as of August 2019 Hezbollah does not yet have an industrial capability to manufacture

precision-guided munitions, but it was “not for lack of trying,” according to an Israeli military spokesman.

How do GPS precision guided missiles work?

- The Fateh 110 and its variants – including the newly upgraded precision missiles – guide themselves to their target using an ‘inertial’ guidance system. The relevant coordinates are pre-programmed into the missile’s computer via a laptop. The missile is fitted with a GPS system as well as accelerometers (motion sensors) and gyroscopes (rotation sensors) which allow the missile to continuously determine its location and velocity (speed and direction).
- The guidance system steers the missile onto the correct path by rotating fins or canards on the outer casing. The solid fuel engine of the missile powers it for around 30 seconds before it continues its flight through inertia. Corrections to its trajectory can continue to be made until its impact at the specified target.

- These missiles are road mobile, meaning that they can be driven around and launched from a wheeled transporter/erector/launcher (TEL) vehicle. The mobility may make the missile harder to locate before it is deployed for launch, but the size of the missile (around 8.5m long) means it must be prepared in the open. This makes it more vulnerable than smaller short-range missiles that can be fired from inside houses, underground bunkers, or other concealed locations. Small cranes are required to lift the missile onto its launcher.
- The accuracy of the system is battle proven. On 8 September 2018, Iran’s Islamic Revolutionary Guards Corps (IRGC) launched seven Fateh-110 missiles from the town of Azarshahr in the country’s East Azerbaijan Province at the headquarters of two Iranian Kurdish opposition parties in the town of Koya, in Iraq’s semi-autonomous Kurdish region (300km north of Iraq’s capital Baghdad and 220km from the missiles’ launch point). While only five or six of the seven fired reached the target, those that did reportedly hit within a few metres.



What does the upgrading process involve?

- [Iran and Hezbollah are attempting to upgrade Hezbollah's existing Zelzal-2 unguided missiles with similar guidance technology to that found in the Fateh-110.](#) The two missiles have similar weight (around 3,500kg) and dimensions (8.5m length, 610mm diameter). The upgrading process requires removing an existing section of the Zelzal 2 and replacing it with a new section which has the following components fitted:
 1. GPS-type navigation system (for tracking the current location of the missile), using either American GPS systems or a Russian Glonass system.
 2. Command and guidance system (for directing the missile towards the target using navigation data and target information).
 3. Control system (for applying guidance commands and steering the missile).
 4. On the outside, small winglets or canards, which can help the missile change direction once in flight.
- [Experts estimate that in a prepared facility, a trained crew could refit one missile in as little as a few hours,](#) though the refit does require specialist equipment, many components, and technical sophistication. The IRGC reportedly established a special department in its Imam Hussein University in Tehran – its official military college which hosts weapons research and development facilities – to train hundreds of Lebanese specialists in producing arms. A former senior Israeli official told BICOM he believed many had likely returned to Lebanon.
- [The components, which are relatively light and the size of small roll-aboard suitcases, are transported from Iran to factories in Syria and Lebanon,](#) either over land, or by air via Damascus, using civilian planes leased from private Iranian companies by the Iranian Revolutionary Guard Corps. These include a civilian, commercial Qeshm Fars Air Boeing 747, identified in media reports citing [US](#) and [Israeli](#) officials. Arms shipments are often stored in the Damascus airport before being transported to Lebanon, or to Iranian army bases in Syria.
- According to a report in the Kuwaiti newspaper [Al-Jarida](#) in March 2017, [IRGC commanders acknowledged building factories for Hezbollah to manufacture both missiles and firearms in Lebanon.](#) According to the report, Hezbollah assumed full control over them in December 2016. The sites are located 50 meters underground and protected by multiple layers of defences from aerial bombardment. According to that report, no facility produces missiles in their entirety, rather each site produces separate parts that are then collected and assembled into complete missiles. In line with this view, one senior Israeli military officer said that the term “factories” was a slight misnomer. “They’re not huge hangars like people imagine, it could be a [small] room,” he told [The Daily Beast](#) in February 2019.
- [Several sites in Syria targeted by the Israeli Air Force \(IAF\) have been part of the Precision Missile Project,](#) according to defence officials cited in [Israeli media.](#) Whilst Israel previously relied on public revelations of intelligence to expose sites inside Lebanon, by August 2019 it reportedly began taking direct action. On August 25 two small Israeli drones allegedly [attacked](#) a site in Beirut’s Dahiyeh quarter, a Hezbollah stronghold, targeting an expensive solid-fuel industrial mixer for guided missiles and its computerised control system. (Solid-state fuel allows missiles to be fueled more discreetly, and also improves the maneuverability and precision of a missile.) These specialised components had reportedly been flown into Beirut airport from Iran and were being held temporarily before their transfer to a missile factory.
- [In early September 2019, Israel revealed the location of a key precision missile factory near the village of Nabi Sheet in eastern Lebanon’s Bekaa Valley.](#) This factory, situated near the Lebanon-Syria border, had housed Iranian-supplied machinery for the production of precision missile motors and warheads.
- [Israel also publicly revealed in late August 2019 the names of four senior Iranian](#)

and Hezbollah officers responsible for the precision-missile programme in Lebanon.

Iranian operations in Lebanon, including the missile programme, are led by IRGC Brig. Gen. Muhammad Hussein-Zada Hejazi, who operates under the direct command of Quds Force commander Qassem Soleimani. IRGC Col. Majid Nuab, a missile specialist, is the technical manager of the precision programme. IRGC Brig. Gen. Ali Asrar Nuruzi is the chief logistics officer of the project, responsible for the transfer of equipment and components from Iran into Lebanon. Fuad Shukr is the senior Hezbollah commander for the precision programme and a close adviser to Hezbollah

secretary-general Hassan Nasrallah. Shukr is also wanted by the US for his role in the 1983 bombing of the Marine barracks in Beirut.

How many precision missiles does Hezbollah currently have?

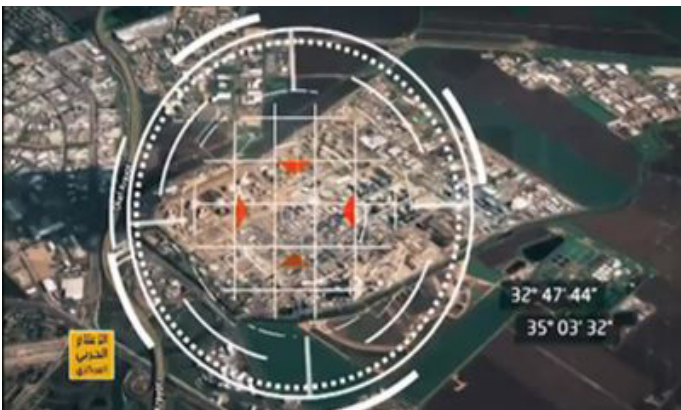
- Israeli experts estimate that Hezbollah aspires to acquire an arsenal numbering in the hundreds or even low thousands, by developing an industrial scale capacity within Lebanon, working with components shipped from Iran. [Hezbollah leaders claim](#) they already possess the ability to strike strategic targets all over Israel.



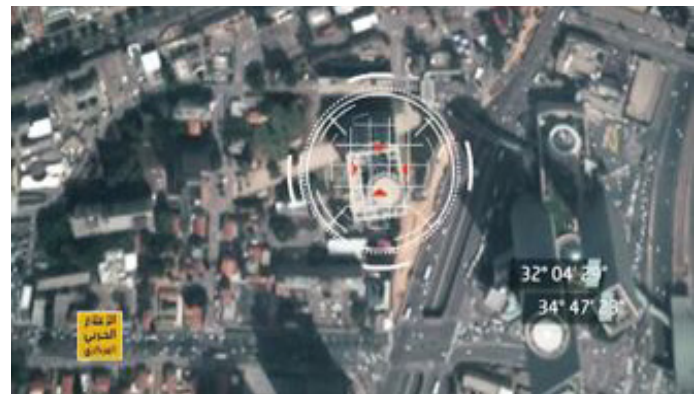
- Israeli officials believe that Hezbollah currently only possess a small number, potentially 20, thanks to Israel's intensive efforts in uncovering the factory sites and targeting weapons on route. In December 2018 outgoing Chief of Staff Gadi Eisenkot told the *New York Times*: "As we speak Hezbollah does not possess accurate [missile] capabilities except for small and negligible ones ... they were hoping to have hundreds of missiles in the mid- and long-range." Iran's financial resources are also squeezed due to the reimposition of nuclear-related sanctions by the US.
- Other experts BICOM spoke to have estimated Hezbollah already has approximately 200 precision missiles. According to this estimate, Hezbollah could already cause a significant amount of damage to Israel. Hezbollah is likely working under the assumption that the more the group possesses, the lower the chance Israel would consider a pre-emptive strike to destroy the threat before it can be used.

What threat do precision missiles pose?

- The precision missiles can do significant damage to Israel's critical infrastructure and urban centres. Mike Elleman, Senior Fellow for Missile Defence at the International Institute for Strategic Studies has calculated that 20-40 precision guided missiles such as the Fateh-110 (which has a CEP of 100m, weighs 3,450kg and has a range of 300km) would destroy a specific, hardened military target with 75 per cent confidence. If Iran has managed to reduce the CEP of its missiles to 50m, as some believe, only ten Fateh-110s or its equivalent would be needed. For softer targets such as urban centres the number of missiles required further decreases.
- Whilst experts disagree about just how precise Iranian missile technology has become (Iranian claims of 10m CEP are doubted by Western analysts), the exact figure is not critical, since the warheads a Fateh-110 can carry could do significant damage even landing 30-50m away, depending on how many are fired, and how well protected the target is.



Haifa Ammonium Factory



The 'Kirya' Defence Headquarters



Negev Nuclear Research Centre (Dimona)



Palmachim Air Force Base

Images taken from a Hezbollah video, Dec 2018

- Israel is a small, densely populated country, depending on relatively few key infrastructure sites. Its most populated cities as well as all its critical infrastructure are located in an area just 20km wide and 80-100km in length. The country has just 12 power stations, three commercial ports (Haifa, Ashdod and Eilat) and Israel's main international airport (TLV Ben Gurion). In 2013, Hezbollah's leader Hassan Nasrallah threatened to 'launch missiles at several power-stations' to 'shroud the whole country in darkness'. In December 2018, Hezbollah published a propaganda video clearly signalling precision capabilities. Nasrallah warned Israel from attacking, with his speech overlaid with satellite images and precise coordinates of significant strategic

sites inside Israel, including:

1. Palmahim Air Force Base, home to helicopter and UAV squadrons, as well as long range Jericho missiles and Israel's space satellite launch pad.
2. Tel Nof Air Force Base.
3. Nevatim Air Force Base, home to five squadrons including Israel's new F35's.
4. Hatzor Air Force Base.
5. The nuclear reactor close to Dimona.
6. The Haifa Oil Refinery.
7. The 'Kirya' Ministry of Defence and IDF Headquarters in central Tel Aviv.

Location of missile factories



Israeli intelligence satellite images revealed three factory sites north of the Beirut International Airport:

- 1) Under a soccer field used by a Hezbollah-sponsored team;
- 2) Immediately north of the airport;
- 3) Underneath adjacent Uza'i waterside neighbourhood.



In September 2019 the IDF published images of a Hezbollah missile factory in the Beqaa Valley

- [Targeting Israel's air force bases could interrupt air force operations, blunting Israel's primary weapon for targeting and destroying missile launchers.](#) Radar stations, which are critical to Israel's missile defences, are also vulnerable, as would concentrations of troops mobilising for ground operations, and Israel's offshore gas facilities.

The regional threat of Iranian precision guided technology

- Over the last decade, [Iran has replicated its Hezbollah militia model to other allies in the region](#), often learning and adapting its methods to make it more covert and harder to detect. One example is the proliferation of precision-guided technology to the Houthi rebels in Yemen, which presents a real threat to Western interests in the region. In October 2018, Houthi forces launched a precision missile called the Badr P-1 – which had visible similarities to the Fateh-110 and Zelzal – near Al Hudaydah, reportedly killing four Sudanese soldiers of the coalition of Arab military forces.
- Although Iran has officially denied all allegations surrounding involvement with the Houthis, UN experts claimed to have [identified](#) 'missile remnants, related military equipment and military unmanned aerial vehicles that are of Iranian origin' within the rebel group's arsenal. In early 2018 the Houthis used missiles called Burkan-1 and Burkan-2, almost an exact replica in range and shape as the Iranian Qiam-1 missile. It is believed that Iran [helped](#) the Houthis domestically develop the Burkan, given the improved guidance systems and stabilising fins the Burkan has.
- The proliferation of precision-guided missiles and the ability to convert standard missiles to precision guided missiles represents a significant upgrade to the military capability of non-state actors and this has forced Western states with interests and armed forces in the region to invest more in missile defence technology. Shia militias in Iraq (Popular Mobilisation Units) and, to a lesser degree, Syria are believed to have obtained some of the capabilities and technology originating in Iran. According to [Western and Iraqi intelligence officials](#), since the start





of summer 2018 Iran began delivering ballistic missiles to its Shia proxies in Iraq. In August 2019 Israeli Prime Minister Benjamin Netanyahu publicly confirmed that Israel was striking Iranian assets inside Iraq. Israeli and US officials had previously [confirmed](#) to the *New York Times* that Israel was responsible for a series of explosions in July-August 2019 targeting Shia militia bases and convoys in Iraq, primarily relating to the transfer or storage of precision missiles. On 30 September Iraq's Prime Minister said his government had "indications" that Israel was responsible for the attacks. Were these capabilities to become widespread it would constitute a very serious threat to US and UK armed forces operating in the region.

PART 2: ISRAEL'S RESPONSE TO THE PRECISION MISSILE THREAT

How has Israel targeted arms convoys and factories in Syria?

- [Shortly after the outbreak of the Syrian civil war – in which Israel generally sought to avoid entanglement – Israel declared the supply of advanced missiles to Hezbollah to be a 'red-line'](#) and vowed to prevent the supply of what it called strategic 'tie-breaking' weaponry, including precision guided missiles. Israeli security officials have confirmed hundreds of sorties on targets in Syria, particularly at the Lebanese border crossing, to prevent Hezbollah obtaining this capability.
- [These targets included storage facilities, weapons convoys, and research and production facilities](#) such as a site in Hisya, south of Homs near the Lebanese border (targeted in November 2017); a research and development facility in Jamraya near Damascus, (targeted in February 2018), and a site near Latakia, (targeted in September 2018). This has formed part of a wider campaign against Iranian forces and proxies being built up in Syria, with [Israel admitting](#) that it dropped 2,000 bombs in 2018.
- [This campaign involved sensitive coordination with Russia.](#) Israeli Prime Minister Benjamin Netanyahu has invested heavily in securing Russian acquiescence to Israeli operations over Syria and Israel has established de-confliction mechanisms to avoid clashing

Israel's missile defence

System	Intercepts	Operational since	
Iron Dome	Rockets and mortars up to 70km - 100 km range (e.g Qassams and Katyushas)	2012	
David's Sling	Medium range heavy payload missiles up to 300km range (e.g. Zelzal 2, Fateh 110, and Syrian M600)	2017 but Israel possesses very few interceptors	
Arrow 2	Long range ballistic missiles over 200km (e.g. Scud missiles or Iranian Shahab missiles)	2000	
Arrow 3	Long range ballistic missiles over 200km during space-flight portion of trajectory	2017	

with Russian planes or air-defence systems. This de-confliction encountered a major crisis in September 2018 when a Russian military aircraft with 15 crew was destroyed by a Syrian anti-aircraft missile fired at Israeli jets on a raid against an Iranian missile factory in Syria. The Russian military blamed the IAF for the incident and decided to provide the advanced S-300 anti-missile system to Syrian government forces. Since then, Israel has been more cautious in its operations over Syria.

Why has Israel used public intelligence revelations to address precision missile facilities in Lebanon?

- Since mid-2017 Israeli political and military leaders have spoken with increasing frequency about Hezbollah's precision missile project within Lebanon, both publicly and in

private with international interlocutors. Unlike in Syria, Israel is reluctant to carry out airstrikes in Lebanon, which could attract international condemnation and risk triggering a conflict with Hezbollah. Instead, Israel has used public warnings including revealing secret intelligence to maximise impact -- what some analysts have termed 'coercive disclosure'. According to [War on the Rocks](#), "Israel has been employing this method as a tool of strategic influence; not only to deter, delegitimize, and otherwise bring pressure on adversaries, but also as a way to gain international legitimacy and shape domestic public opinion".

- Prime Minister Benjamin Netanyahu utilised his September 2018 speech to the UN General Assembly to reveal Israeli intelligence satellite pictures of three factory sites north of the Beirut International Airport: one under

a soccer field used by a Hezbollah-sponsored team; one immediately north of the airport; and one underneath the adjacent Uza'i waterside neighbourhood. In mid-December 2018 Netanyahu said Hezbollah had shut down those sites after Israel exposed them.

- [Beginning in August 2019, and in the face of what it said were intensifying Iranian efforts to produce precision missiles in Lebanon, Israel shifted tactics.](#) In addition to increasing the volume and detail of its public declarations and intelligence revelations surrounding the precision missile programme, Israel also reportedly finally took direct action -- striking via two small drones, as mentioned, precision missile components in the Dahiyeh neighborhood of Beirut. According to *Haaretz* and other sources, the Beirut strike damaged a planetary mixer — an industrial-sized mixer weighing about eight tons, needed to create propellants that can improve the engine performance of missiles and increase their accuracy. The machine was hit, as far as is known, shortly before Hezbollah planned to move it to a secured site.
- Hezbollah retaliated to the drone attack in early September 2019, firing several anti-tank missiles toward an Israeli army base and vehicle near the Israel-Lebanon border. Israel responded by firing some 100 artillery and tank shells into Lebanese territory, reportedly striking the Hezbollah missile team. Despite Hezbollah leader Nasrallah saying that Israel “must pay a price” for the alleged drone attack, the group’s response was on the whole calculated and the escalation was soon contained -- aided in part by the anti-tank missile missing the IDF vehicle and causing no casualties on the Israeli side.
- [The Israeli government would like to see the Lebanese government and Lebanese Armed Forces,](#) which are backed by Western political and economic support, as well as the United Nations Interim Force in Lebanon (UNIFIL) take action against Hezbollah and Iran’s precision missile project.
- [According to Israeli military and diplomatic officials, Iran is attempting to move missile components and other materiel into Lebanon via official crossings at the Lebanon-Syria border;](#) on civilian flights into Beirut International Airport; and on ships arriving at Beirut

port. Referring to the Lebanese Government, one Israeli security official [said](#) in August 2019: “They are the ones who are complicit in endangering Lebanon and Lebanese civilians which Hezbollah and Iran are using as human shields.”

- [In an April 2019 visit to Beirut, US Secretary of State Mike Pompeo urged the Lebanese government to hold Hezbollah accountable.](#) According to a senior US official: “Pompeo raised before [Lebanese] Prime Minister [Saad] Hariri his concerns over Hezbollah’s actions in Lebanon. The actions of Hezbollah are a threat to Lebanon. ... we made it clear to the government of Lebanon that ... the danger of escalation with Israel as a result [of Hezbollah’s actions] is real.”

[Does Israel have the option of a pre-emptive strike inside Lebanon?](#)

- [Israeli political and military leaders frequently take the opportunity to convey the extent of their intelligence to Hezbollah,](#) as well as emphasising Israel’s readiness and capabilities to strike at the group’s capabilities.
- [However, notwithstanding the 25 August drone strike in Beirut \(reportedly attributed to Israel\), the option of a real pre-emptive strike inside Lebanon presents a sharp dilemma for Israeli decision makers.](#) Israel has a legacy of pre-emptive military action against strategic threats, including its successful destruction of nuclear reactors in Iraq (1981) and Syria (2007), and in a much more acute situation, the Egyptian Air Force in 1967. The significance of the threat of precision missiles makes a pre-emptive strike inside Lebanon an option for Israeli decision makers, were they to gain intelligence that Hezbollah was acquiring a significant arsenal. However, any such pre-emptive strike would almost certainly lead to a major violent conflagration that both sides are loathe to undertake. Israeli decision makers would also be concerned about the level of international support for such a move, which also helps explain Israel’s strategy of making public statements about the threat.
- Indeed, by summer 2019 Israel had [elevated](#) its threat perception of Iran’s precision missile programme, placing it only second

behind Iran's pursuit of a nuclear weapon. According to one senior Israeli defence official, the order of priorities was now "nuclear, precision, area" (i.e. Iran's efforts to militarily entrench itself in Israel's near abroad, as in Syria). Former Israeli military intelligence chief Amos Yadlin publicly speculated whether the so-called 'Begin Doctrine' -- in the past solely used to pre-empt enemy states' nuclear weapons acquisition -- would be applied to Hezbollah's precision guided missile programme.

How effective are Israeli missile defences?

- [Israel has been developing missile defence systems since the 1980s](#), to address the long range ballistic missile threat especially from Iraq and Iran. Israel now has a multi-layered missile defence system coupled with highly advanced radar systems. On January 18 2016, speaking at a Tel Aviv conference on national security, Israel's then Chief of Staff Gadi Eisenkot outlined the future force structure of the IDF. Prominent among them was a "four or five tier missile defence system that will provide Israel with the most advanced capability in the world." The system includes several elements in various stages of development and deployment:
- [Whilst Israel's capabilities in missile defence are arguably the most comprehensive and capable in the world, they cannot provide hermetic protection](#). Missile interception systems can potentially be overwhelmed by multiple launches and decoys. If enough precision missiles were fired at a target it is assumed that some will inevitably get through. Though Israel's radars can distinguish missiles heading for critical infrastructure and / or urban centres (which it can intercept) from those which will fall in open areas (which it can ignore), missile interceptors are still extremely expensive to deploy, in comparison to the missiles they are defeating, especially the short-range missiles. With limited batteries available, Israel may have to prioritise the defence of critical infrastructure from precision missiles and leave population centres more exposed.
- [Missile defence also includes strengthening critical infrastructure](#), and the IDF Home

Front Command and government ministries have carried out fortification work to secure several strategically vital sites against missile attacks. Representatives of government ministries and Israel's National Emergency Management Authority formulated a classified list of key sites that required reinforcement materials, with the process guided by an evaluation of each site's importance to the country's ability to continue to function during an emergency. A [source](#) from the Home Front said that "each site is fortified in accordance with the threat posed to it", while emphasising that "this is about improving survivability...there is no such thing as 100 per cent protection."

- In a military conflict with Hezbollah, [Israel's defence would also include intensive air force operations over Lebanon to disrupt Hezbollah's ability to coordinate fire](#), prevent the simultaneous launch of large numbers of missiles and ensure the location of missile launchers are destroyed immediately after their detection.

What is the significance of the IDF's new 'missile corps'?

- [In January 2018 Israeli media reported a government decision to establish a new force of precision ground-to-ground missiles](#) with a range of up to 300km, which would provide an alternative to the air force for precision strikes against enemy targets including missile launchers. The decision was taken by then Defence Minister Avigdor Lieberman together with then Chief of Staff Gadi Eisenkot. The new corps is intended to provide an alternative strike capability in case the air force is hampered by precision missile attacks on its bases.

Does Israel have the capability for jamming or spoofing of GPS guidance?

- [Another potential form of defence against precision missiles is jamming](#), which can interrupt the capacity for devices within a specific area to communicate with navigation satellites, denying them the ability to target accurately. Independent experts remain uncertain to what extent Israel has the capacity to do this with missiles from Lebanon, and whether jamming could also interrupt the

IAF's ability to strike back. In addition, jamming will only interfere with the accuracy of the missile in its final stages, and an incoming missile could still do significant damage in a populated area, even if it were prevented from hitting its intended target.

Appendix

IRANIAN PRECISION TECHNOLOGY : A COMPARISON

The precision guided technology used by Iran is less sophisticated than that of the UK or US whose precision guided missiles are capable of hitting movable objects. In 2017 the Ministry of Defence revealed that it had paid Raytheon £400m since 2015 on **Paveway IV** precision-guided bombs (CEP 15m, £70,000 per missile) for use against ISIS targets in Syria and Iraq. Each Paveway IV incorporates a dual mode system that uses both anti-jamming GPS and semi-active laser (SAL) for its guidance.

The UK military also uses the **Brimstone missile** (CEP under 1m, £175,000 per missile) a fire-and-forget system that requires no further interaction once it has been launched. Each missile is equipped with a millimetric wave radar seeker, allowing it to track its target autonomously if mobile, and providing the capability to operate in all weather conditions; and a highly advanced guidance system which uses a range of data to direct the controls and reach the target. In 2018 the UK military introduced a new precision-guided weapon, known as the Exactor 2, which can engage targets at 25-30km and be launched from land, air and naval platforms. The weapon guidance is a combination of electro-optical and infrared cameras. The system can be operated automatically, which means that the missile independently guides itself to the selected target without interference, or it can be controlled by a human operator. The weapon can be re-targeted mid-flight or self-destruct if necessary.

In 1998 the US sought to upgrade its dumb missiles into precision guided missiles. Boeing heritage company McDonnell Douglas Corp was awarded a contract to supply the air force with a low-cost guidance kit (the Joint Direct Attack Munition - JDAM) which converted existing “dumb” bombs into accurately guided “smart” weapons (to a CEP of 5m or less). The cost of each unit was approximately \$20,000. According to a 2007 UK National Audit Office report, Raytheon's Enhanced Paveway kit used by the UK – which transforms “dumb” bombs into precision dual-mode, GPS/INS and laser-guided “smart” munitions – costs \$48,000 per unit.

The US military's most recognised precision-guided bomb is the **Tomahawk missile** (CEP 10 m, £667,000 per missile). This missile has been used by the Royal Navy since the late 1990s and was used in the Kosovo conflict and in the UK's military campaigns in Afghanistan, Iraq and Libya. In 2017 the US fired 59 Tomahawks into Syria as a response to President Bashar Al-Assad's use of sarin gas. The **Block IV TLAM-E** (CEP 10m) is the latest Tomahawk version. The missile can be rerouted in-flight to either pre-planned or new targets by using GPS.

HOW MUCH DOES THE PRECISION PROJECT COST?

IDF intelligence estimates that since the beginning of the Syrian Civil War, Iran has invested \$17bn in Hezbollah and Syria, which includes opening a credit line to Syria of several billion dollars, as well as annual aid to Hezbollah of \$700m – \$1bn. The Joint Comprehensive Plan of Action (JCPOA) agreed between Iran and the P5+1 powers in 2015 led to the lifting of sanctions and the release of billions of dollars of Iranian assets and allowed Iran to invest heavily in the project.

It is difficult to estimate an exact budget for the precision project because the manufacturing and assembly process does not directly correlate to a Western manufacturing process, in which the cost per unit charged by a manufacturer includes a significant cost for research and development.

Total Iranian costs for the precision project would include: creating the components; smuggling them into Lebanon; establishing the right assembly facilities; and labour costs of subsequently fitting the kits onto the Zelzal missile. The costs are covered from different budgets within Iran. For example, the R&D is included under one secret budget; refining the designs is covered by the Iranian domestic missile programme; and moving the components and subsequently upgrading the missile is paid for by the IRGC Quds Force. In addition, the cost of smuggling the various parts into Lebanon undetected is changeable based on the specific situation on the ground.

It is estimated that the final stage of the process – once facilities have been built and relevant parts smuggled into Lebanon – comprising fitting the kits into the missiles would cost between \$5,000-\$10,000 per unit.

This report has been produced by BICOM's research team in consultation with experts in the UK, the US and Israel. We are especially grateful for the help of Uzi Rubin, considered the father of Israel's missile defence programmes; Mike Elleman, Senior Fellow for Missile Defence at the International Institute for Strategic Studies; and Dr Jack Watling, Research Fellow in Land Warfare Military Sciences at the Royal United Services Institute.

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