

Ballistic and cruise missiles in the Middle East: the current landscape and options for arms control

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Introduction

Missiles have long played a key, if relatively understudied, role in Middle Eastern security dynamics. According to Dennis Gormley's 2017 estimate, over 90% of all missiles used in conflict since the Second World War have been in the Middle East.¹

Today, the determination of regional actors to procure or develop ballistic and cruise missiles shows no immediate signs of abating. Missiles play a growing role in national defence doctrines in the region and many states are driven to acquire them due to the increasing appreciation of their utility as conventional precision-strike systems, as well as symbols of military prowess. Their frequent use by local and external powers in recent and ongoing conflicts in the Middle East and the possibility of even further regional proliferation have driven calls to explore the application of arms controls to manage regional missile developments.

This paper surveys the evolving missile landscape in the Middle East and considers some of the possible options for regional missile control. These two themes form the paper's two parts. The paper starts by exploring some of the key contemporary trends related to missiles in the Middle East. It examines the various regional powers interested in advanced missiles and the emergence of non-state actors as users and developers of missile technology. It also explores the regional

appeal of cruise missiles and considers the growing use of advanced missiles as conventionally armed stand-off weapons. Finally, this section explores the regional interplay between offensive and defensive missiles. The second part of the paper charts some of the recent attempts to develop regional arms controls and considers some of the approaches to missile control, including some cross-cutting themes that any missile control efforts might wish to address.

While missile holdings in the Middle East have grown in terms of the types, ranges and platforms used, this paper focuses its examination on ballistic and cruise missiles of ranges exceeding 250 kilometres.² The value and reach of this range can vary in different sub-regional settings but is used here as a rough metric indicating the ability to target across borders, as well as a reflection of a degree of technical capability. While the paper incorporates land-attack missiles, it excludes missiles that are closely tied with battlefield or tactical missions, such as those with shorter ranges as well as anti-ship and air-defence platforms. Similarly, armed uninhabited aerial vehicles (UAVs) are excluded from the analysis. While their use has grown in prominence, particularly in some regional conflicts including in Syria, Libya and Yemen, they form a separate category of weapons with distinct dynamics, and thus pose different questions for arms control.³

Chapter 1. Ballistic and cruise missiles: regional dynamics and current trends

State profiles: two tiers of actors

There are 11 states in the Middle East with ballistic- or cruise-missile holdings with ranges of over 250 km.⁴ Additionally, two non-state actors also have the capability to launch missiles with such ranges (see Table 1). This figure accounts for nearly half of the total number of states globally that possess either ballistic or cruise missiles. The region's disproportionate level of possession demonstrates how these weapons have decidedly moved into the mainstream of military doctrines in the Middle East, particularly within the last 20 years.

Part of the appeal of ballistic and cruise missiles is that, if the system's guidance and propulsion technology is sufficiently advanced, operators can conduct precision strikes against valuable enemy political, economic and military targets. Ballistic and cruise missiles also extend the reach of operators, thereby allowing for regional power projection beyond national borders.

Missiles also have symbolic value as markers of strength and are sometimes openly paraded to domestic and international audiences for that purpose. In the case of cruise missiles, they can provide operators with a level of deniability, particularly if they follow a circuitous flightpath, making them difficult to attribute.⁵

The missile landscape in the Middle East is increasingly diverse. Some of these actors have historic associations with developing missiles, while others are new entrants into this domain. A limited number of regional states have indigenous capacities to design and develop missiles, but the majority rely on importing complete missile systems and, in some cases, draw on external expertise to operate and maintain them. Considering these divergent profiles, regional state actors can be divided into two distinct groups representing different capabilities and competencies.

Tier 1: advanced missile powers with indigenous and diverse holdings

While the region has several countries with significant missile holdings, Israel and Iran stand out on account

An Israeli *Shavit* space-launch vehicle, June 2007. Israel's nuclear-armed *Jericho 2* medium-range ballistic missile is believed to be the basis for the *Shavit*.



(Handout/Handout via Getty Images)

of their advanced and diverse missile capabilities and their ability to leverage indigenously developed designs and production bases.

Israel's interest in ballistic missiles began in the 1950s, and in 1963 it started a concerted effort to develop its first credible ballistic-missile system, with French assistance.⁶ Building on its increasingly advanced aerospace industry and focusing on developing superior technology to account for the quantitative limitations of its armed forces, Israel was able to deploy its first short-range ballistic missile, the *Jericho 1*, by 1973, despite France terminating its support before the under-development system was complete.

Israel is assessed to operate short-, medium- and possibly intermediate-range ballistic missiles (SRBM, MRBM and IRBM respectively) for both conventional and nuclear deterrence. Israel is widely believed to operate a nuclear triad and has the capacity to deliver nuclear weapons from air, land and sea platforms.⁷ However, due to Israel's policy of nuclear ambiguity, it is difficult to fully ascertain the capabilities of the different systems and platforms it has allocated for nuclear-weapons delivery, especially the range of these systems and their respective throw weights.

It is believed that the land leg of Israel's nuclear triad consists of at least one variant of the *Jericho* series of ballistic missiles. The *Jericho 2* is an MRBM with a likely range of 1,800 km, placing around half

of Iran, including Tehran, within range. It is thought to be capable of carrying payloads up to 1,000 kilograms. Israel is known to have tested a successor, a longer-range system known as the *Jericho 3*, which may be based on the *Shavit* space-launch vehicle (SLV).⁸ Whether this latest iteration has entirely replaced the *Jericho 2* is unknown, but experts have suggested it is capable of striking targets at a distance of around 4,000 km with a 750 kg warhead.⁹ This longer-range system places all of Iran within range of Israel's ground-based systems, and possibly also other states with nuclear capabilities that some experts have suggested Israel may hedge against, such as Pakistan.¹⁰ Israel is also believed to operate a submarine-launched cruise missile for nuclear-weapons delivery, although there is uncertainty as to the design of that system.¹¹

Israel also possesses several types of indigenously developed cruise missiles, such as the *Delilah* and *Popeye* series that are utilised across different land, air and sea platforms, providing the capability to conduct precision strikes.¹² Israel also allegedly operates a conventionally armed SRBM, named Long Range Artillery (LORA).

Iran is the Middle East's other prominent regional missile power, as it possesses an advanced and diverse indigenous missile arsenal. Iraq's frequent use of ballistic missiles against Iranian civilian and military targets during the Iran–Iraq war partly spurred Tehran's desire to acquire and subsequently develop its own missiles.¹³ A further driver in Iranian missile ambitions is the role these can play to compensate for Iran's limited air power. Until October 2020, Iran had been under various UN Security Council sanctions, such as UNSCR 1929 and UNSCR 1747, which limited Tehran's ability to service its air force and procure new equipment, resulting in Iran being qualitatively and quantitatively behind its regional rivals in terms of aerial capabilities. Consequently, Iran's defence doctrine has emphasised the role of missiles as a necessary military equaliser and as an instrument to boost domestic as well as regional prestige and deterrence.¹⁴

What distinguishes Iran's missile capability, as with Israel's, is its development of a local production and design capacity that gives its missile programme relative autonomy from external suppliers, although it still receives some foreign technical assistance,

An Iranian *Dezful* short-range ballistic missile and *Zolfaghar* medium-range ballistic missile paraded during the 42nd anniversary of the Islamic Revolution, February 2021. Iran has the largest and most diverse ballistic-missile arsenal in the Middle East, and Tehran regularly displays these systems as an instrument to boost domestic as well as regional prestige and deterrence.



(NurPhoto/NurPhoto via Getty Images)

especially from China and North Korea.¹⁵ The experimental nature of some Iranian missile designs might account for the limited appearances of some systems, not of all which are believed to be in service. Of those that are known to be deployed, several variants, especially those deriving from Iran's liquid-fuel missile programme, share a common ancestry derived from its earliest acquired ballistic-missile technology.¹⁶ For instance, the *Shahab* series are known to be copies or variants of the Soviet-designed *Scud-B*, which Tehran acquired from Libya and North Korea during the Iran–Iraq war. Despite some of the drawbacks associated with liquid-fuel missile technology, Iran has continued upgrading existing systems within its inventory and developing new systems, but with an emphasis on improving accuracy.¹⁷ Iran has developed at least eight different types of liquid-fuel missile, ranging from short-range systems, such as the *Shahab* and *Qiam* variants, to medium-range systems such as the *Emad* and *Khorramshahr* (see Table 2).¹⁸

Iran also possesses solid-fuel ballistic missiles, such as the short-range *Fateh* variants. It is also developing medium-range systems such as the *Zolfaghar*. Solid-fuel missiles provide users with some advantages over liquid-fuelled systems as they can be launched faster, minimising the possibility for an adversary detecting and pre-emptively targeting them, thereby improving the system's survivability.

Accurate estimates of the range of Iran's various ballistic-missile designs are difficult to confirm, but it

Table 1: Ballistic-missile holdings of Tier 1 states

Operator	Missile name	Range (km)	Payload (kg)	Fuel type	Circular error probable (CEP) (m)
Israel	LORA	430	240	Solid	10
Israel	<i>Jericho 2*</i>	1,800	1,000	Solid	?
Israel	<i>Jericho 3*</i>	4,000	750	Solid	?
Israel	<i>Rampage</i> (air-launched ballistic missile)	?	?	Solid	10
Iran	<i>Shahab-1</i>	300	1,000	Liquid	700–1,000
Iran	<i>Shahab-2</i>	500	730	Liquid	>1,500
Iran	<i>Qiam-1</i>	800	500	Liquid	>1,000
Iran	<i>Qiam-1 mod. (Qiam-2?)</i>	800	500	Liquid	~100
Iran	<i>Shahab-3</i>	800–1,000	760–1,000	Liquid	2,500
Iran	<i>Ghadr-1</i>	1,600	750	Liquid	300
Iran	<i>Emad</i>	1,600	700	Liquid	?
Iran	<i>Khorramshahr-1/-2</i>	2,000	500–1,800	Liquid	1,500
Iran	<i>Tondar</i>	150	190	Solid/liquid	300
Iran	<i>Fateh-110</i>	300	450	Solid	<100
Iran	<i>Khalij Fars</i>	300	450	Solid	<100
Iran	<i>Hormuz-1/-2</i>	300	450	Solid	<100
Iran	<i>Fateh-313</i>	500	350	Solid	<100
Iran	<i>Fateh Mobin</i>	500	350	Solid	<100
Iran	<i>Raad-500</i>	500	350	Solid	<100
Iran	<i>Zolfaghar</i>	700	350	Solid	<100
Iran	<i>Zolfaghar Basir</i>	700	350	Solid	<100
Iran	<i>Dezful</i>	1,000	350	Solid	?
Iran	<i>Shahid Haj Qasem</i>	1,400	350	Solid	?
Iran	<i>Sajjil-1/-2</i>	2,000	700	Solid	300

* Service status uncertain
 Source: IISS, *The Military Balance 2021*

is believed that some designs are capable of travelling up to 2,000 km. Iran is believed to have a self-imposed range limit of 2,000 km that is attributed to Supreme Leader Ayatollah Ali Khamenei.¹⁹ Whether Iran will adhere to this range limit in the future is unknown.

To complement its ballistic-missile arsenal, Iran is also developing and diversifying its cruise-missile capabilities. This effort began with Iran’s covert acquirement of six Soviet-designed Kh-55 (RS-AS-15 *Kent*) cruise missiles from Ukraine in 2001.²⁰ Several names are associated with development efforts based on this airframe, including *Meshkat*, *Soumar* and *Hoveizeh*. Producing a land-attack cruise missile on the basis of the Kh-55 has been hampered by the lack of an adequate engine. As well as a Kh-55-derived missile, where the ambition was to produce a weapon with a range of at least 2,000 km, Tehran has also developed the *351/Quds* cruise missile. This is a shorter-range and simpler weapon, but one that has proved operationally effective.

Tier 2: limited indigenous capacity and reliance on external suppliers

While Israel’s and Iran’s missile arsenals stand out in the Middle East, other regional states also have considerable capabilities. However, these states have more limited indigenous capacity to produce their own designs and a narrower diversity of missile types, even if some of them harbour ambitions to develop an indigenous missile base or have already started down this route.

This tier includes NATO member Turkey, which is developing several indigenous SRBMs, some of which draw on Chinese technology and assistance.²¹ Turkey is also cooperating with Ukraine to procure propulsion units for an under-development sea-launched cruise missile named *Gezgin*.²² In addition, Turkey has produced an indigenously designed air-launched cruise missile, the Stand-Off Missile (SOM), which has reportedly been in service with the Turkish Air Force since 2015.²³

Satellite image of the al-Dawadmi solid-fuel production and test site. The complex, known as base 544, was completed in 2013. The presence of a solid-fuel burn pit suggests that Saudi Arabia is seeking to develop solid-fuel ballistic missiles.



(NurPhoto/NurPhoto via Getty Images)

Other second-tier states include Algeria, Egypt, Saudi Arabia and the United Arab Emirates, as well as other Gulf Cooperation Council (GCC) states. The missiles operated by these countries originate from several different sources, including China, Russia and the United States. For instance, Algeria operates a variety of Russian systems and associated platforms, including the *Iskander-E* SRBM, *M54 Klub* (SS-N-27 *Sizzler*) submarine-launched cruise missile (SLCM) and *Kilo*-class submarines.²⁴ Historically, Egypt was an early regional entrant into the missile age, with plans to develop its own missile capabilities dating back to the 1960s, but has not had much success.²⁵ Egyptian plans were revived in the 1980s through a joint venture with Argentina and Iraq, known as the *Condor II* project, which ultimately did not come to fruition.²⁶ Egypt's missile arsenal includes legacy *Scud* missiles of Soviet origin as well as more recent French-supplied air-launched cruise missiles (ALCMs) with a range of 250 km.

Among the GCC states, Saudi Arabia possesses two ballistic missiles of Chinese origin, the liquid-fuelled DF-3 (CH-SS-2) and the solid-fuel DF-21 (CH-SS-5). These systems have ranges of 3,000 km and 2,000 km respectively.²⁷ They constitute the core of Saudi Arabia's Strategic Missile Force, which Riyadh might also be seeking to expand further, given evidence that it appears to be constructing a facility to produce solid-fuel missiles domestically and procure a Ukrainian-designed SRBM.²⁸

Saudi Arabia also possesses the British–French *Storm Shadow/SCALP* ALCM, which it purchased in 2011.²⁹ Other GCC states including Bahrain, Qatar and the UAE also possess small ballistic-missile arsenals from a variety of origins, including Chinese missiles, in the case of Qatar.³⁰ Bahrain, Kuwait and the UAE all possess cruise missiles of Western origin. The UAE also appears to be building its domestic industry to produce advanced weaponry.³¹ This has included cooperation with external defence firms such as South Africa's Denel, as well as the indigenous development of stand-off munitions by Emirati firms such as HALCON Systems.³² While historically Syria and Yemen once had considerable ballistic arsenals, these have been significantly eroded due to use and lack of maintenance in their respective civil wars.³³

The rise of non-state actors

States are not the only regional actors with missile capabilities and ambitions. The growing prominence of non-state actors' missile arsenals has become one of the new features of the region's missile landscape, and some groups are demonstrating remarkable capabilities considering their relatively limited resource bases. Without the capacity to operate significant air or maritime forces and project power beyond their immediate environment, these groups find value in using missiles as a way to target

Table 2: Ballistic-missile holdings of Tier 2 states					
Operator	Missile name	Range (km)	Payload (kg)	Fuel type	Circular error probable (CEP) (m)
Algeria	9K720 <i>Iskander-E</i> (RS-SS-26 <i>Stone</i>)	280	480	Solid	<10
Bahrain**	MGM-140A ATACMS	165–300	174–221	Solid	>50
Egypt	9K72 <i>Elbrus</i> (RS-SS-1C <i>Scud-B</i>)	300	770–950	Liquid	1,000
Egypt	9K72 <i>Elbrus</i> (RS-SS-1D <i>Scud-C</i>)	600	770–950	Liquid	<1,000
Qatar	BP-12A (CH-SS-14 Mod 2)	280	480	Solid	?
Saudi Arabia	DF-3 (CH-SS-2)	2,780	2,000	Liquid	1,000–4,000
Saudi Arabia	DF-21 (CH-SS-5)	2,150	600	Solid	300
Syria	OTR-21 <i>Tochka U</i> (RS-SS-21 <i>Scarab B</i>)	120	482	Solid	<100
Syria	M-600 (license-built <i>Fateh-110</i>)*	250–300	450–500	Liquid	500
Syria	9K72 <i>Elbrus</i> (RS-SS-1C <i>Scud-B</i>)*	300	770–950	Liquid	1,000
Syria	9K72 <i>Elbrus</i> (RS-SS-1D <i>Scud-C</i>)*	600	770–950	Liquid	<1,000
Syria	9K72 <i>Elbrus</i> (RS-SS-1E <i>Scud-D</i>)*	700	770–950	Liquid	50
Turkey	J-600T <i>Yildirim I</i>	150	480	Solid	150
Turkey	J-600T <i>Yildirim II</i>	300	480	Solid	<150
Turkey	MGM-140A ATACMS	300	213–247	Solid	>50
Turkey	<i>Bora</i>	280	470	Solid	<10
UAE	9K72 <i>Elbrus</i> (RS-SS-1C <i>Scud-B</i>)	300	770–950	Liquid	1,000
UAE	MGM-168 ATACMS	300	221	Solid	>50
UAE	9K72 <i>Elbrus</i> (RS-SS-1D <i>Scud-C</i>)	600	770–950	Liquid	<1,000

* Service status uncertain

** Which variant of the MGM-140A Bahrain purchased is uncertain.

Sources: <https://www.govinfo.gov/content/pkg/FR-2018-11-08/html/2018-24403.htm>; <https://missilethreat.csis.org/missile/ss-21/>; <http://www.nukestrat.com/us/afn/NASIC2006.pdf>, page 8; <https://www.dsca.mil/press-media/major-arms-sales/bahrain-m31-guided-multiple-launch-rocket-system-gmlrs-unitary-and>; <https://twitter.com/Kryuer/status/1235930736043208705>.

adversaries' military forces, population centres and critical national infrastructure to inflict military and political damage.³⁴ These groups have also developed a limited capacity to handle and reassemble dismantled missiles sent from state backers, which has eased the difficulties associated with transporting large systems intact.³⁵

Two sub-national groups in particular stand out when it comes to missiles: Hizbullah in Lebanon and the Houthis in Yemen. Both proxy groups have strong links to Iran, with Hizbullah also having close ties with the Syrian government. They have both managed to build up an arsenal of missiles, although information about their holdings, particularly those of Hizbullah, is more difficult to verify.

Hizbullah's extensive arsenal contains systems of various ranges, roles and levels of guidance. The group

is estimated to possess perhaps as many as 130,000 rockets and missiles in total, a nearly nine-fold increase in the number of systems it possessed during the 2006 Lebanon War.³⁶ The vast majority of these are rockets of a comparatively simple design, but by having significantly increased the size of its arsenal, Hizbullah may be able to severely pressure Israeli air and missile defences in a future conflict and complicate and over-extend Israeli counterforce-targeting capabilities.³⁷ As well as expanding the number of unguided rockets it possesses, Hizbullah is also improving the range and accuracy of some systems, such as the *Fateh-110*, to conduct increasingly accurate strikes that could be used to target large Israeli military or civil installations.³⁸ The group has benefitted from its links with Iran and the opportunities that came with its involvement in the

A ballistic-missile launch by the Houthis, March 2018. The Houthis utilised captured Yemeni government missiles to strike Saudi civilian and coalition military targets in the earlier phases of the conflict. The group has also received significant technical and material assistance from Iran.



(AFP via Getty Images)

Syrian civil war to expand the size and lethality of its arsenal through technology transfers from state backers. Israeli assessments indicate that Hizbullah has the ability to produce guided surface-to-surface missiles but identified that the group has encountered problems in trying to mass-produce them.³⁹

Houthi stockpiles are more verifiable given their frequency of use against the Saudi-led coalition and regular public displays for propaganda purposes. Moreover, with the collapse of President Ali Abdullah Saleh's government, the Houthis are known to have taken control of significant portions of the government's missile stockpiles, including *Scud* and OTR-21 *Tochka* (RS-SS-21 *Scarab*) SRBMs.⁴⁰ In addition to capturing government stockpiles, the group has domestically manufactured UAVs as well as some guided and unguided rockets, such as the *Badr-1P* and the *Badr-F/Nakkal*.⁴¹ The Houthis have also managed, through Iranian mentorship and assistance, to reassemble transferred components of ballistic and cruise missiles.⁴²

The evolution of the Houthis' missile inventory is reflected in their increasing ability to strike targets deep into Saudi Arabia. Prominent early missile attacks against the Saudi-led coalition, for instance, utilised types of SRBMs which the Houthis were known to have acquired from Yemeni government sources.⁴³ However, subsequent missile attacks against targets in Saudi Arabia attributed to the Houthis, such as the one against Riyadh in 2018 and the 2019 attack against Saudi Aramco facilities, used ballistic and cruise missiles that exceeded the range and type of their known

Yemeni government stockpiles.⁴⁴ It is therefore highly likely that some of these systems are of Iranian origin.⁴⁵ As well as supplying missiles to non-state actors, however, Iran also appears 'intent on enabling all its main proxies to be able to autonomously manufacture artillery rockets and precision-guided missiles'.⁴⁶

The growing appeal of land-attack cruise missiles (LACMs)

Ballistic missiles have historically been the dominant type of advanced missiles in the Middle East, evidenced by their historical proliferation, use and coveted by regional states. While this interest continues, regional actors are increasingly attracted to acquiring land-attack cruise missiles (LACMs) due to their increasing utility as precision-strike weapons, their capacity to stress air and missile defences, the opportunity to use them in asymmetric warfare and the fact that many regional states possess suitable aerial launch platforms.⁴⁷ The proliferation of LACMs in the region mirrors the growth of cruise-missile possession internationally. In 2001, for instance, only three states (Russia, the United Kingdom and the United States) operated conventionally armed LACMs, but by 2021, that number had swelled to 23.⁴⁸ Within this timeline, the number of Middle Eastern states that either possessed or had LACMs on order increased from one (Israel) to nine, in addition to one non-state actor, the Houthis.

Most LACMs travel at subsonic speeds on low-altitude flight profiles and use terrain masking to increase their survivability against air defences. They present a different problem for a defender when compared to a ballistic missile.⁴⁹ During the 2003 Iraq War, for instance, US *Patriot* missile defences managed to intercept nine ballistic missiles launched by Iraq but failed to intercept any of its five relatively crude LACMs.⁵⁰ This makes them a cost-effective way of challenging an adversary with advanced missile-defence systems.

Advances in Iran's missile arsenal have also led some US allies in the region to acquire LACMs for counterforce roles. The UAE purchased a variant of SCALP/EG named *Black Shaheen* from France in the 1990s, although it is likely that some modifications were made to the missile to make the

Table 3: Land-attack cruise-missile holdings in the Middle East

Operator	Missile name	Range (km)	Payload (kg)	Platform	Initial operational capability (IOC)
Algeria	3M54E <i>Klub</i> (RS-SS-N-27B)	220	200	<i>Varshavyanka</i> (improved <i>Kilo</i> -class SSK)	2009
Egypt	<i>Storm Shadow</i> /SCALP EG	>300	400	<i>Rafale</i>	2020
Houthis	351/ <i>Quds</i> -1	~700	?	?	By 2019
Iran	351/ <i>Quds</i> -1	~700	?	?	By 2019
Iran	<i>Quds</i> -2 *	<1,000	?	?	?
Iran	<i>Meshkat</i> / <i>Soumar</i> *	>2,000	?	?	By 2013
Iran	<i>Hoveizeh</i> *	1,350	?	?	By 2019
Israel	Submarine-launched cruise missile (possibly <i>Popeye 'Turbo'</i> variant)	?	Unknown nuclear/conventional	<i>Dolphin</i> -class SSK	By 2010
Israel	<i>Popeye</i>	90	350	?	By 1995
Israel	<i>Popeye 2</i>	90	350	F-16l <i>Fighting Falcon</i>	By 1995
Israel	<i>Popeye 'Turbo'</i>	>300	?	?	2002
Israel	<i>Delilah</i>	250	30–54	F-15l <i>Ra'am</i> F-16l <i>Fighting Falcon</i>	By 1995
Kuwait	<i>Storm Shadow</i> /SCALP EG	>300	400	<i>Typhoon</i>	On order
Qatar	<i>Storm Shadow</i> /SCALP EG	>300	400	<i>Rafale</i>	On order
Saudi Arabia	<i>Storm Shadow</i> /SCALP EG	>300	400	<i>Tornado</i> <i>Typhoon</i>	2009
Turkey	SOM-A	250	230	F-4 <i>Phantom</i> F-16 <i>Fighting Falcon</i>	2012
Turkey	SOM-B	250	230	F-4 <i>Phantom</i> F-16 <i>Fighting Falcon</i>	2018
UAE	<i>Black Shaheen</i> (<i>Storm Shadow</i> /SCALP EG)	>300	400	<i>Mirage</i> 2000-9	2004

* Service status uncertain

** Which variant of the MGM-140A Bahrain purchased is uncertain.

Sources: <https://www.govinfo.gov/content/pkg/FR-2018-11-08/html/2018-24403.htm>; <https://missilethreat.csis.org/missile/ss-21/>; <http://www.nukestrat.com/us/afn/NASIC2006.pdf>, page 8; <https://www.dsca.mil/press-media/major-arms-sales/bahrain-m31-guided-multiple-launch-rocket-system-gmlrs-unitary-and>; <https://twitter.com/Kryuer/status/1235930736043208705>.

transfer arguably compliant with export guidelines of the Missile Technology Control Regime (MTCR).⁵¹ The UAE’s acquisition of *Black Shaheen* may have encouraged several other regional states including Egypt, Kuwait, Qatar and Saudi Arabia to also acquire variants of the same system from willing Western suppliers.⁵² Conversely, the United States’ refusal to supply *Tomahawk* cruise missiles to Israel in 2000 might have spurred its development of an indigenous cruise-missile design.⁵³ Cognisant of the capabilities and benefits offered by cruise missiles, Iran began developing its own series of LACMs after acquiring six Soviet-made Kh-55 (RS-AS-15 *Kent*) systems in 2001. It is likely that Iran had used these Soviet systems to improve its own manufacturing capabilities.

Beyond WMD: missiles as conventionally armed stand-off weapons

Concerns about missile proliferation in the Middle East have been closely tied to fears emanating from their association with weapons of mass destruction (WMD).⁵⁴ The limited accuracy of early ballistic and cruise missiles helped engrain the view that they were primarily useful with payloads able to inflict wide-scale damage to compensate for their poor accuracy. The association of WMD with missiles still has resonance in the region, particularly when considering Iraq’s use of ballistic missiles with chemical payloads during the Iran–Iraq War; Israel’s reliance on ground- and sea-launched missiles for nuclear-weapons delivery; and the anxiety surrounding Iran’s missile programme, which it could

ultimately use to deliver nuclear weapons if it were to develop them.

But while the link with WMD is ever present, guidance and accuracy improvements render this factor insufficient to fully understand the utility of missiles in the Middle East, patterns of their recent use and consequential implications for regional stability. The use of increasingly accurate missiles armed with conventional warheads has become a common occurrence in regional military operations. The Syrian civil war provides an example of the extensive use of conventionally armed LACMs by a diversity of regional and external actors – for example, by France, Israel, Russia, the UK and the US – while Russia and Syria have also made limited use of conventionally armed ballistic missiles.⁵⁵

The prominence of missile defence

Responses to offensive missile programmes in the Middle East have mirrored action–reaction dynamics in other regions, whereby states seek to improve their defences to mitigate adversaries’ regional offensive capabilities. Interest in missile defences in the Middle East markedly increased following Iraqi ballistic-missile attacks that targeted both Saudi Arabia and Israel during the 1991 Gulf War.⁵⁶

In light of the apparent emerging threat posed by ballistic-missile systems, Israel has since developed a sophisticated tiered air- and missile-defence architecture. *Iron Dome* is tasked with defending against rockets and other small ordnance, while *David’s Sling* is able to intercept cruise missiles and SRBMs endo-atmospherically. The *Arrow 3* system operates on the top tier and is capable of intercepting incoming ballistic missiles exo-atmospherically with a kinetic kill vehicle.⁵⁷

Among the GCC states, the acquisition and use of missiles by Iran and its non-state proxies has accelerated national efforts to expand missile defences. Although efforts to develop integrated missile defences indigenously have remained limited, some GCC states have submitted significant equipment requests to the US to improve their defensive capabilities. This includes, for instance, the potential sale of 44 Terminal High Altitude Area Defense (THAAD) launchers to Saudi Arabia, which is expected to be completed by 2027, and the potential sale of *Patriot* PAC-3 systems

to the UAE and Bahrain, valued at \$2,728 billion and \$2.478bn, respectively.⁵⁸

Despite efforts by the Saudi-led coalition to thwart Houthi missile and UAV attacks, including a reported 162 intercepts of Houthi-launched missiles between March 2015 and April 2020,⁵⁹ the 2019 Saudi Aramco attacks demonstrated weaknesses in protection against multidirectional threats. Efforts to pool GCC resources into common coordinated missile defence have so far not been successful, despite US efforts to encourage it.⁶⁰ Cognisant of the GCC states’ counterforce capabilities, especially from ALCMs and their associated air platforms, Iran too has built up a capable missile-defence capability, relying on a mix of imported systems such as the Russian S-300 and indigenously developed systems like the recently revealed *Bavar-373*.⁶¹

Historically, the US has been the main provider of advanced missile-defence capabilities within the region, although other states are now making this environment more competitive. Russia is increasingly considered by some regional states as a potential alternative supplier, with Moscow having supplied or offered its S-300 and S-400 missile-defence systems to several Middle Eastern countries, including US allies such as Qatar, Saudi Arabia and Turkey. Despite apparent inroads by Moscow, Saudi Arabia eventually rejected the possibility of procuring the S-400 due to its planned purchase of THAAD.⁶² Qatar previously expressed an interest in buying the S-400, but as of 2022, no contract has been signed.⁶³

Regional investments in air and missile defences have led to refinements and adjustments in the offensive systems deployed to overcome them. For instance, attackers might seek to overwhelm defence systems with volleys of missiles and rockets. Attempts to saturate missile defences were visible during the May 2021 conflict between Israel and Hamas, where the latter attempted to overwhelm Israel’s *Iron Dome* system with large volleys of rockets.⁶⁴ Additionally, missile-defence infrastructure has also become a target of UAV and sabotage attacks. In 2017, it was reported that Houthi rebels targeted UAE-operated *Patriot* systems by attacking their main phased arrays.⁶⁵ More recently, in 2019, the Houthis claimed a UAV attack on a *Patriot* battery stationed at Najran Airport in Saudi Arabia.⁶⁶

Chapter 2. The challenges of cooperative arms control in the Middle East

There are currently no region-wide mechanisms to control or limit ballistic or cruise missiles; nor are there any concerted arms-control efforts. Gaining support for proposals for the control of missiles in the region will prove challenging, in part because Middle Eastern states have not managed to develop regional frameworks that can enable security cooperation. There is currently no framework that brings together the Gulf Cooperation Council (GCC) and other Arab states, Iran, Turkey and Israel to provide a platform for sustained dialogue on regional security issues. Furthermore, a lack of common interests among the states of the region is the main impediment in identifying shared goals for arms-control or risk-reduction initiatives that would be beneficial for all.

Despite this, there have been some limited regional successes. The 1979 Egyptian–Israeli peace treaty incorporated some arms-control measures regarding the demilitarisation of specified areas and limitations on the deployment of certain weapons systems.⁶⁷ It also included on-site verification measures to check compliance with restrictions and limitations.⁶⁸ The same concepts were then considered for subsequent peace settlements in the context of the Arab–Israeli peace process.⁶⁹ This suggests that verifiable regimes of military restraint among regional players are possible.

Yet the historical record also shows that regional arms control remains challenging. An important example of this is the Arms Control and Regional Security (ACRS) working group that was formed in the early 1990s as a result of the 1991 Madrid Conference. The ACRS working group fitted within a larger structure that included bilateral negotiations between some Arab states and Israel as well as a broader multilateral track that covered region-wide issues, one of which addressed regional security.⁷⁰ The working group was important for its inclusion of Israel alongside many of the key Arab states, despite some notable regional absences such as Iraq and Iran, who objected to the broader Madrid process. The ACRS effort led to a series of meetings and discussions between officials

from regional states in Track I, alongside several Track II meetings between 1991 and 1995.

While ACRS presented a unique forum for regional arms-control discussions, it also highlighted some of the structural difficulties facing meaningful regional arms control. Soon, differing views within the working group about the meaning of regional security and the potential scope of arms control stymied agreement on any practical next steps. For instance, Egypt and some of the other Arab states were keen to discuss the regional nuclear imbalance.⁷¹ Conversely, Israel wanted to shift the discussion away from nuclear issues and onto conventional weapons and general regional security.⁷² These differing approaches were also expressed through divergent proposed solutions, as Arab states called for nuclear-arms-control commitments, whereas Israel advocated for confidence-building measures (CBMs) or confidence- and security-building measures (CSBMs).⁷³

The clash of priorities, as well as the derailment of broader regional peace talks under the Madrid process, eventually led to the demise of the working group. This episode highlights that even within the context of peaceful relations, such as those between Egypt and Israel, the issue of arms control, and the form and pace it might take, can pose intractable challenges. It can be expected that the inclusion of other states (especially those with aggressive foreign policies) into these discussions would complicate the debate even further and put agreement on practical measures towards risk reduction, such as arms control and CBMs, out of reach. Such measures can only succeed when the participating states share a common interest in avoiding conflict, but when one or more states is weaponising risk to achieve their aims, arms control is impossible.

Another round of regional discussions on arms control began following the 2010 Nuclear Non-Proliferation Treaty (NPT) Review Conference (RevCon). The RevCon reached agreement on a 64-point action plan including practical steps on the establishment of an effectively verifiable Middle East zone free of weapons of mass destruction and their delivery systems (ME WMDfZ).⁷⁴

Among the action points was the convening of a conference with the participation of regional and other states to discuss the proposed free zone.⁷⁵ However, after three rounds of negotiations in 2013 and 2014, chaired by Finnish diplomat Jaakko Laajava, no agreement was ultimately reached on the modalities or agenda of such a conference, leading to the demise of the process and exchanges of accusations of responsibility for its failure, which further poisoned the outcome of the 2015 NPT RevCon and continues to loom over the NPT process.⁷⁶

More recently, in 2018, a UN General Assembly (UNGA) decision was adopted in support of holding a

diplomatic conference on the ME WMDFZ.⁷⁷ This initiative was pushed by the Arab states and supported by Iran. With a UNGA mandate in place, the first conference was held in November 2019 in New York, but without the participation of Israel and against the backdrop of objections from the US and the UK.⁷⁸ The conference produced a political declaration and follow-on conferences are planned to be convened annually, thus creating in effect a standing forum for discussing the ME WMDFZ proposal.⁷⁹ However, without Israel's participation, the conference's ability to reach meaningful arms-control measures that apply to the whole region will be limited.

Chapter 3. Options for missile control in the region

The fate of the Arms Control and Regional Security (ACRS) working group and the Middle East zone free of weapons of mass destruction (ME WMDFZ) highlights the challenging context for arms control in the region. Thinking about a cooperative framework to address the threat of advanced missiles in the region must contend with that complicated legacy, as well as the different priorities of regional states on security threats and how they seek to instigate or mitigate them. This section explores three different modalities or approaches to regional arms control.

Option 1: country-tailored/targeted approach

The first option focuses arms-control measures on a single actor whose missile holdings are deemed a regional or international concern. In doing so, this approach provides a selective way to deal with regional missile proliferation rather than creating direct linkages between missile holdings of various regional actors. An example of this approach would be the nuclear deal with Iran, officially known as the Joint Comprehensive Plan of Action (JCPOA), which established negotiated restrictions on Iran's nuclear capabilities agreed by Iran and other international parties without directly affecting other capabilities or additional regional states.

Some of the more recent arms-control proposals aimed specifically at addressing Iranian missiles also fall into this category.⁸⁰ These proposals are a response to the expansion of Iran's inventory of missiles and their increased precision, and also to proliferation concerns, particularly proliferation of missiles by Iran to non-state actors as part of its ongoing proxy wars against Israel and Saudi Arabia. They are aimed at applying explicit and strict restrictions on Iran's missile programmes, similar in style to the nuclear restrictions under the JCPOA; the initiative has come about partly in response to criticism levelled at the Iran nuclear deal for not adequately addressing the missile issue.⁸¹ One proposal is to use Iran's self-imposed range limitation of 2,000 km and develop this into an

Representatives from the P5+1 discuss the Joint Comprehensive Plan of Action with Iranian officials in July 2015. Although the nuclear deal did not include restrictions on Iran's missile programme, a country-tailored approach might incorporate adjusted elements of the agreement to target Iran's missile programme.



(Joe Klamar/AFP via Getty Images)

explicit joint agreement or obligation.⁸² To compensate for this restriction, the proposal would allow Iran to continue developing its space programmes, including its development of space launch vehicles, uninterrupted. In principle, a country-tailored approach similar to this example can also be applied to other regional missile programs.

While a country-tailored approach might be attractive, it has its challenges. Using Iran as an example, convincing Tehran to agree to limitations on its missile programme would be monumental, considering the role of missiles in Iran's strategic posture and their propaganda value for the Iranian government.⁸³ Such an agreement would therefore require a strong external sponsor to offset some of the concessions made by the restricted state in question through security guarantees, and would therefore be unimaginable without intensive diplomatic engagement and leadership from outside the region. However, if such an approach were to be successful, it could be used as a stopgap measure to quickly address advances of one specific national missile programme without the added complexity of incorporating other regional states. However, providing credible security guarantees may be too difficult for any state to deliver, considering the complex and difficult security environment in the region. This approach would also invite risk, as security guarantees from an external state

might necessitate their involvement in a regional war, thereby increasing the risk of a broader regional conflict.

Option 2: regional-based approach

The second option focuses on developing a region-wide solution to missile proliferation in the Middle East. It would seek to reach a negotiated solution between all or some of the key regional states by subjecting them to missile restraints, for instance by capping parameters such as range, number, type and payload, and introducing proliferation controls. The advantage of this approach, and conversely a key challenge, is that it creates a set of new, region-wide rules of acceptable behaviour concerning missiles. If successful, it could foster a regional impetus to implement restrictions similar to, or even stronger than, those contained in the Missile Technology Control Regime (MTCR) and the Hague Code of Conduct (HCoC), neither of which has widespread regional participation. It also could involve some quid pro quo deals between regional states to address other aspects of regional security, reduce tensions and allow the states to seek further confidence-building measures (CBMs) or even resolve bilateral or wider political conflicts and security concerns. This approach would also allow regional actors to frame their concessions related to missiles to other, cross-domain bargains and reciprocal regional concessions.

A regional missile-control regime has featured in some earlier proposals related to other ongoing processes such as the NPT. It is noteworthy that the ME WMDFZ proposal explicitly includes delivery systems.⁸⁴ Yet this remains its least developed aspect, and rarely features in international or regional discussions on the zone. One proposal suggested by Michael Elleman put forward a region-wide ban on the development and possession of ballistic missiles with ranges exceeding 3,000 km.⁸⁵ This agreement would include Iran, Israel, Turkey and members of the Arab League, and could be framed in the context of achieving progress towards the ME WMDFZ or pursued independently. Rather than an outright ban, another proposal, by Tytti Erästö and Pieter Wezeman, suggested developing more modest CBMs or confidence- and security-building measures (CSBMs) regarding certain types of missiles that can apply regionally, beginning with Iran and the Gulf states.⁸⁶

Either of these two approaches – whether taking the formal route of an ME WMDFZ or a separate regional route – will have to overcome many of the same challenges faced previously by the ACRS process and other regional efforts to remove WMDs. The most prominent of these are mutual mistrust between regional states, limited political will and different views on how security within the region can be achieved.

Option 3: international restriction on missiles

Rather than pursue a country-targeted or regional route, this approach follows an international route to indirectly restrict or constrain missile developments in the region. This would entail externally imposed restraints by actors outside the region, delivered either through individual state policies or in an agreement between a larger number of states. While this might appear imposing, in practice it is the least ambitious among the different modalities available for addressing missile proliferation. It amounts to a continuation of export controls enforced nationally and some constraints agreed among international suppliers about the conditions and nature of missile transfers.

One of the features of missile control internationally is the lack of solid international norms, especially compared to nuclear, chemical or biological weapons. The two key instruments, the MTCR and the HCoC, are voluntary measures rather than legally binding ones. While the MTCR focuses on limiting the spread of missiles carrying a 500-kg payload at least 300 km, the HCoC provides a wider set of CBMs and transparency measures related to ballistic missiles.⁸⁷ These regimes can be strengthened and some of the gaps, particularly as applied to the Middle East, can be addressed.⁸⁸ Both instruments make direct linkages between the threat of missiles and their use in connection to WMDs, but breaking that link would increase their regional applicability and help address the increasingly widespread use of ballistic and cruise missiles and uninhabited aerial vehicles (UAVs) that are used to deliver conventional payloads. For instance, extending MTCR membership to some of the region's burgeoning missile and UAV producers would, in theory, impede the potential for proliferation of systems

above the regime's warhead and range threshold. The HCoC can also inspire useful CBMs among regional states. Encouraging regional uptake would therefore be a welcome step to decrease the destabilising influence of missiles and UAVs.

Cross-cutting themes for missile control

Whatever form a missile-control regime might take, there are several cross-cutting themes that such an effort will need to address.

Firstly, it needs to consider effective criteria to control the possession of missiles. For example, should the agreed limits focus on the numbers and types of missiles, or a missile's range, warhead capacity and the platform used to launch it, or a combination of these factors?

Secondly, any such effort would require deciding on what missile activities are desirable or useful to control. This could include restrictions on deployments and use that might be considered destabilising, limiting the development and testing of certain technologies, and restricting transfer and trade of missiles to third parties (especially prohibiting proliferation to non-state actors).

Thirdly, a regime will also need to address the link between legitimate space programmes and prohibited missile activities. Given that space programmes typically build on advances in military technology, as

opposed to military activities benefitting from civilian activities, addressing the dual nature of relevant technologies, such as propulsion, will be key to ensuring that peaceful activities are not used as a cover for military programmes.

Fourthly, as this paper has shown, the problem of regional missiles is not solely linked to their value as delivery platforms for WMDs. Following a broader framework can potentially address the surge of regional proliferation and the use of ballistic and cruise missiles and UAVs armed with conventional payloads.

Fifthly, given the growing prominence of non-state actors in the regional missile landscape, it is worth developing modalities where proposed controls can be effectively applied to non-state as well as state actors.

Finally, transparency and verification measures could be an immensely useful component of any such arrangement. As the experience of verifying the destruction of Iraqi missiles under the United Nations Special Commission has shown, these tasks can come with their own challenges regarding the level of acceptable access and intrusiveness. Furthermore, some measures, such as export controls, are harder to verify. But some regional CBMs, even without verification, can act as stepping stones to increase momentum towards CSBMs and arms control.

Conclusion

The missile landscape in the Middle East is witnessing a significant transformation. Regional interest in offensive and defensive missiles and uninhabited aerial vehicles (UAVs) has been steadily growing over the past three decades and is likely to continue to do so in the near future. For the time being, there are two tiers of missile possessors in the region: those with significant indigenous production capabilities, notably Israel and Iran, and a larger category of states with access to advanced imported systems. Collectively, they form a picture of a region where contestation, risk and missile competition are playing increasingly prominent and intersecting roles. Given the efforts of some regional states to become less reliant on imported technology and develop their own missile and UAV systems, instability is growing between the 'haves' and 'have-nots', which is further eroding global missile-control regimes and exacerbating tensions across the region. One can now clearly see a pathway towards a new wave of proliferation ungoverned by export controls and unrestrained by normative frameworks.

Other trends add to the evolving complexity of the regional landscape. Land attack cruise missiles are growing in appeal, and nine regional states have added them to their inventories. Against the backdrop of regional conflict and instability, missiles and advanced UAVs have been used with increasing frequency as conventionally armed stand-off weapons to achieve national political and military objectives. It is no surprise that many regional states have started developing missile-defence capabilities in response and, in some cases, have invested significant resources towards that end. This, in turn, has forced new adaptations in how offensive missile and UAV systems are designed and used. All this is taking place in a context where states are no longer the only regional actors

possessing advanced missiles. Non-state actors, such as Hezbollah and the Houthis, are acquiring and operating various missile systems that were once possessed only by states with advanced military capabilities. In their hands, missiles are used as a force multiplier and an asymmetric tool capable of inflicting physical damage and economic harm against stronger and better-equipped opponents. Overall, regional conflicts have shown themselves to be an increasingly permissive environment for the use of conventionally armed ballistic and cruise missiles.

All this points to the importance of considering effective arms control, confidence-building measures (CBMs), confidence- and security-building measures (CSBMs) and risk-reduction measures to mitigate the threat these missiles pose in the region. This is complicated by the lack of existing region-wide mechanisms to control or limit ballistic and cruise missiles, as well as the absence of a concerted regional effort for arms control more broadly. The history of regional arms controls shows how challenging this task can be. Without a regional framework for security dialogue, and with different views on viable regional solutions and sometimes clashing preferences on regional security, developing a regional arms-control agenda will continue to prove challenging. Yet this should encourage the redoubling of efforts to explore innovative yet practical solutions to the region's complex security environment. Consideration of arms-control, CBM, CSBM and risk-reduction modalities shows a menu of options for missile control, ranging from country-tailored to region-wide to international in scope. It might be wise to follow multiple concurrent routes from this menu of options while developing a more comprehensive vision of the form and substance of missile controls; one that would ultimately reduce the evolving missile threats in the region.

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