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# Iran's Ballistic Missile Arsenal Is Still Growing in Size, Reach, and Accuracy

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Brief Analysis

**Tehran has doubled down on the strategic importance of missile systems that can threaten U.S. forces and allies, even as its defensive justifications for such an arsenal ring more hollow than ever.**

**W**hen the Joint Comprehensive Plan of Action (JCPOA) was first being formulated and implemented in 2015-16, negotiators reluctantly concluded that in order to achieve meaningful progress, they would need to isolate the nuclear deal from other areas of major concern. Notwithstanding whether that was a wise decision or not, each of these areas has since undergone substantial changes that merit closer scrutiny now that new negotiations are taking place. Perhaps the most pressing concerns stem from the regime's missile development and proliferation activities, which predictably continued apace following the JCPOA.

## Digging in Strategically

Iran's efforts on this front have been a subject of scrutiny since at least 1998 when it first tested the Shahab-3 ballistic missile, and the program's progress has been steady ever since despite occasional setbacks. Today, the country's military and political leaders use every opportunity to reiterate that foreign attempts to limit these activities risk crossing a fundamental redline. Indeed, the Islamic Revolutionary Guard Corps (IRGC) has dug in for the long term against a vastly superior U.S. foe, tapping a remarkable array of resources to develop new capabilities. Tehran shows no sign of slowing these advancements, which it deems essential to security goals such as threatening

Israel's existence, holding U.S. regional bases at risk, empowering foreign proxies, and deterring internal or external attacks against regime centers of gravity (e.g., nuclear and military industries).

Toward that end, the imperative of establishing a robust missile capability has been enshrined in various official documents and statements. During the August 25 parliamentary confirmation assembly for Defense Minister Mohammad Reza Qaraei Ashtiani, for example, the general committed his institution to prioritizing Iran's strategic missile capability above other force multipliers. He also emphasized using domestic resources and industries to circumvent international sanctions on missile-related technologies, and to facilitate more export and foreign production of missile capabilities once Iran replenishes its own strategic stocks. Similarly, in President Ebrahim Raisi's [first budget request](#) submitted to parliament on December 12, the equivalent of 210 million euros is dedicated to ballistic missile projects under the name of the late IRGC missile chief Hassan Tehrani Moghaddam, in addition to other unspecified portions of the expanded defense budget that will be devoted to that sector. All of these commitments build on the aerospace roadmap Iran ratified in 2013, which called for continuing missile development to deter threats and launch satellites.

## New Systems and Underground Sites

Iran has unveiled ten new ballistic missiles and three new satellite launch vehicles (SLVs) since 2015, along with several new transport and launch systems and methods. It has also revealed the existence of multiple underground missile complexes, or so-called "missile cities." The first three complexes were officially unveiled in September 2015, January 2016, and May 2017 after years of development. Currently, almost every province is believed to have at least one deeply buried ballistic missile storage and launch site, with satellite imagery showing numerous construction and expansion projects across the country, mainly oriented toward the south and southwest.

One new capability demonstrated since 2020 is an automated missile launch system that can position up to five fully fueled ballistic missiles on an underground railcar for sequential ripple-fire launch through a single vertical shaft. Another system for Iran's smaller solid-fuel missiles employs buried fixed-launch canisters, reminiscent of the American MX missile's "buried trench" concept of the Cold War era.

Tehran is also suspected of working on large-diameter solid-propellant rocket stages for use on future SLVs and intermediate-range or intercontinental ballistic missiles (IRBMs/ICBMs). In a December 2005 letter to Supreme Leader Ali Khamenei, the since-deceased Tehrani Moghaddam dutifully reported that two of his high-priority projects had reached their final stages: a hypersonic rapid-reaction missile capable of reaching Israel, and an SLV. In 2008, Iran unveiled its first SLV and its Sejil two-stage solid-propellant missile, which is believed capable of achieving a reentry speed more than five times the speed of sound. By 2010, the IRGC was [successfully test-firing](#) a large solid-propellant motor. IRGC general Mohammad Tehrani Moghaddam has also alluded to the existence of an ICBM development program originally under his late brother's direction.

More recently, Iran unveiled its newest solid-propellant motors—named Salman and Zoheir—last year. And in early 2021, it launched its first multistage solid-propellant SLV on a suborbital test mission (albeit with a liquid-fuel first stage as a stopgap measure).

## Advances in Precision Guidance and Range

Another feature incorporated since 2015 is more capable terminal precision guidance. With the Imad missile, the IRGC could steer a separating warhead for highly accurate (if not precision) guidance at ranges approaching 1,700 kilometers. In 2017, Iran introduced the Khoramshahr, whose liquid-fuel engine configuration was supposedly developed with North Korea's help if not completely imported. This missile is reportedly capable of carrying large payloads—potentially including miniaturized nuclear warheads—to a range of 2,000 km. Chairman of the Armed Forces General Staff Gen. Mohammad Bagheri has further claimed that it offers a CEP (circular error

probable, a standard measure of precision) of 60 meters at a range of 1,300 km. And last year, the Khoramshahr-2 was unveiled with a steerable warhead, potentially enabling it to deliver higher accuracy and survivability at a range beyond 2,000 km if armed with smaller warheads.

If Iran achieves a consistent CEP of 10 meters or better with medium-range ballistic missiles and other platforms, it could be a game-changing capability. The regime has already demonstrated this degree of precision with shorter-range systems reportedly used in high-profile operations over the past few years, such as the September 2018 strike on a meeting of Iranian dissidents in Iraqi Kurdistan, the September 2019 strike on Saudi Aramco facilities, the January 2020 strike on U.S. targets at al-Asad Air Base in Iraq, and the annual Great Prophet military exercise. In theory, a conventional ballistic missile attack using highly accurate or precision-guided systems could replicate the geopolitical effects of a small nuclear weapon—provided they are combined with other advanced capabilities such as effective anti-missile defense countermeasures (e.g., low-observable material, separating controllable warheads, complex maneuvering flight profiles, hypersonic midcourse and reentry speeds) and/or complex attack tactics (e.g., synchronized use of loitering munitions to attack missile defenses). The regime has demonstrated progress in some if not all of these areas, in addition to expanding its use of electro-optical imaging seeker heads for precision guidance on ballistic missiles.

Yet the reach of Iran's solid-propellant systems has shown even faster progress. In 2015, the Fateh-313 was unveiled with a range of 500 km, a significant improvement over the previous version's 300 km. To maximize destructive power along with range, designers incorporated more composite materials in the body and motor casing.

Iran's latest solid-propellant guided missile, Raad-500, is significantly shorter than its predecessor (7.61 m compared to 8.86) yet can reportedly reach 500 km. Its warhead is smaller but still powerful, and designed to separate in the early midcourse phase, making it more difficult to detect, track, and intercept than unibody missiles (e.g., Fateh-110) or those with warheads that separate in the terminal phase.

## From Offense to Defense?

**A**s demonstrated in last year's al-Asad base attack, Iranian solid-fuel semi-ballistic missiles pose a significant threat to nearby U.S. forces and facilities in Iraq, Syria, and the Persian Gulf. They could also be used to threaten commercial shipping in the area along with economic and military infrastructure. While missiles themselves can serve both defensive and offensive purposes, the Islamic Republic's missile program was founded on a heavily ideological offensive base.

For instance, Iranian officials frequently attempt to justify the program by citing lessons learned from the urgent defensive measures implemented during the 1980s war with Iraq. Yet this example is misleading—Tehran did not start shopping for ballistic missile technology from Libya, Syria, North Korea, and China in earnest until the offensive phase of that war, when Iranian forces were advancing inside Iraq with the goal of conquering Baghdad and then continuing toward Jerusalem. In keeping with the regime's ideology of exporting the Islamic Revolution, this strategy was subsequently aimed at Riyadh and U.S. military assets as well.

To be sure, the IRGC's ballistic and cruise missile programs have also resulted in respectable defensive capabilities, and its military deterrent power is multipronged. Yet its increasingly accurate, lethal, and longer-range missile force has arguably become the most important aspect of Iran's overall military doctrine.

Interestingly, the regime's longstanding strategic focus on increasing the range of its systems is being supplanted with high accuracy now that the necessary technology is available. Therefore, it may be worth exploring whether Tehran can be persuaded to officially and verifiably dispense with range beyond a certain point in favor of a reasonable arsenal of advanced short-range missiles that fulfill its legitimate defensive needs.

Of course, this option would not be feasible unless it were discussed within a context of regional rapprochement,

since even Iran's shorter-range systems currently pose a significant threat to U.S. partners in the region. Israel and the Gulf states are understandably concerned that short-range missiles or loitering drones with precision-guided capability can put their strategic infrastructure at risk if launched from forward positions.

Yet with this caveat in mind, the international community has every reason to press Tehran on dismantling its longer-range missile program. Notwithstanding its false historical analogies, the regime has no legitimate defensive requirement for a surface-to-surface missile range beyond 300 km. Originally, the only purpose for such a capability was to support the expansion of Iran's regional influence and create the backbone for long-range missiles capable of carrying nuclear warheads, at a time when Tehran was far away from fielding precision-guided ballistic missiles.

Even if these fears were dispelled under the most optimistic circumstances—that is, if Iran, Israel, and other players hypothetically agreed to pursue a serious regional de-escalation and deconfliction process—the scale of Tehran's current missile efforts would not make sense. When countries have normal relations with each other, they can rightfully be expected to develop legitimate defensive capabilities such as modern airpower and seapower. Yet a missile arsenal has at least one key difference: it is not nearly as transparent, and therefore lends itself to distrust and misconstrued intentions.

Ultimately, whatever inducements Washington and other actors might contemplate, the reality is that Iran in its current political and ideological form is almost certain to reject any agreement with the West that includes considerable restrictions on its missile capabilities. On the contrary, the regime should be expected to continue increasing these capabilities indefinitely, including the range factor. And even if Tehran were willing to discuss such restrictions, establishing a verification mechanism for safely dismantling its existing long-range arsenal and monitoring any forward-deployment of missiles would be a similarly monumental task—especially now that it is producing smaller, more mobile missiles with longer ranges.

That said, Washington and other actors should still explore interim measures that might facilitate an informal understanding. More broadly, the ongoing JCPOA talks and the specter of renewed pressure on Tehran provide an opportunity for Washington to once again highlight the dangers that Iran's ever-expanding missile development and proliferation activities pose—not just to regional states, but potentially further abroad if the program continues down the road it has followed for the past three decades.

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