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The Iranian Missile Challenge

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There is no doubt that Iran and North Korea present serious security challenges to the U.S. and its strategic partners, and that their missile forces already present a major threat within their respective regions. It is, however, important to put this challenge in context. Both nations have reason to see the U.S. and America's strategic partners as threats, and reasons that go far beyond any strategic ambitions.

Iran is only half this story, but its missile developments show all too clearly why both countries lack the ability to modernize their air forces, which has made them extremely dependent on missiles for both deterrence and war fighting. They also show that the missile threat goes far beyond the delivery of nuclear weapons, and is already becoming far more lethal and effective at a regional level.

This analysis examines Iran's view of the threat, the problems in military modernization that have led to its focus on missile forces, the limits to its air capabilities, the developments in its missile forces, and the war fighting capabilities provided by its current missile forces, its ability to develop conventionally armed precision-strike forces, and its options for deploying nuclear-armed missiles.

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Iran's Perceptions of the Threat

Iran has certainly carried out missile developments that could allow it to deliver nuclear warheads anywhere in the region, hit much of Europe, and develop some form of ICBM. This presents an all too real potential threat if the JCPOA or alternative efforts to halt Iran's nuclear programs should fail.

However, there is another side to Iran's missile programs, and to the perceptions and strategic considerations that drive them – what the British strategist Liddell Basil-Hart called the "other side of the hill." Seen from an Iranian perspective, Iran is responding to proven threats from its neighbors and the U.S., and its inability to properly modernize its military forces since 1980.

Iran provoked the hostage crisis with the U.S. in 1979, but this crisis was a reaction in part to the Anglo-American coup that brought the Shah back to power in 1953. It also led to a broad cutoff in U.S. and European arms transfers that has continued ever since ever since 1980, and left Iran

heavily dependent on aircraft, surface-to-air missiles, armor, and ships that were developed in the 1960s and 1970s.

The hostage crisis was also casualty free. The Iran-Iraq War was not. Iraq invaded Iran that same year, and Iraq's Arab neighbors, Europe, and the U.S. then backed Iraq once the Iraqi invasion collapsed after Iran's successful creation of a massive mix of conventional and "revolutionary" military forces in the first two years of the eight year-long Iran-Iraq War. Iraq ultimately recovered, however, and the war crippled Iran's economy, and produced estimates of up to 1,000,000 casualties and 500,000 dead – although the number of the casualties on each side is highly questionable.

The Iran-Iraq War also exposed a very real Iraqi nuclear, chemical, and biological threat, and Iraq triggered a missile war against Iran's cities. This led to Iran creating its own missile forces, and the revival of the Iran chemical warfare and nuclear programs that Khomeini had cancelled.

While France and Russia led the arming of Iraq, the U.S. played its own role in shaping Iran's defeats in 1987 and 1988. The reflagging of Kuwaiti tankers led to a U.S.-Iranian "tanker war" in 1987-1988. At the same time, America's European allies provided major transfers of arms to Iraq, including modern combat aircraft, surface-to-air missiles, and some precision munitions.

Iran has exploited Arab divisions and fault lines ever since the end of the Iran-Iraq War, and has sometimes covertly attacked U.S. forces and targets. The aftermath of the Iran-Iraq War saw periods where the U.S. and Iran seemed to be easing their tensions, along with periods of improvements in Gulf Arab and Iranian relations. However, it also saw the creation of permanent U.S. bases in the Gulf, and the steady improvement of every aspect of Israeli as well as Arab forces.

The first Gulf War to liberate Kuwait in 1990-1991 then demonstrated the rising levels of U.S. and Arab military capabilities and triggered a further major build-up of Southern Gulf Arab forces that has continued ever since. The U.S. ended low-level cooperation with Iran over the Afghan conflict after 2001 because of the "axis of evil" policy. The U.S.-led invasion of Iraq in 2003 then placed major U.S. forces in Iraq on Iran's border. While most of these forces withdrew in 2011, the U.S. then returned to face the rise of ISIS.

While the U.S., its Arab partners and Israel all have good reason to see Iran as a threat and a cause of regional instability, Iran's leaders and senior military feel they have equal cause to see all three as a major threat. The ongoing struggles for control and influence in Syria, Iraq, Lebanon, Yemen, and the Gaza are not the result of some abstract Iranian interest in exporting a revolution. From an Iranian perspective, they are a natural reaction to an all too real threat.

Iran's Inferiority in Arms Imports

It is also a threat where Iran's missile programs are part of a focus on asymmetric warfare where Iran has had no other options. Like its Arab neighbors, Iranian military modernization is critically dependent on arms imports. So far, Iran has not been able to raise its military production capabilities to the point of producing most forms of advanced major weapons, although it has done well in producing missiles, munitions, and smaller weapons systems. Iran has also only had sporadic access to Russian arms and no recent access to advanced new combat aircraft, tanks, major combat ships other than three submarines.

The totals for the Arab side show that Iran is anything but the hegemon of the Gulf. If one looks only at the Arab GCC states – and ignores Israel and Iraq – the GCC states have had continuing access to the most modern arms available since at least 1990, and have taken full advantage of the fact.

From 1980 to the present, Iran has faced massive new U.S. and European arms transfers to the Southern Arab Gulf states. If one looks at the volumes of new arms import orders reported by the Congressional Research Service using declassified U.S. estimates since the end of the first Gulf War, the Southern Arab Gulf states alone had had a vast lead over Iran in total imports from all sources.

The latest such CRS numbers cover 2008-2015. According to this report, Iran ordered only ordered \$900 million worth in 2008-2015. In contrast, Saudi Arabia ordered \$93,500 million worth during 2008-2015. The UAE ordered \$25,700 million, Bahrain ordered \$900 million, Kuwait ordered \$8,000 million, Oman ordered \$10,500, and Qatar ordered \$23,900. The GCC total for these six states – which ignores the cost Egypt, Iraq, Israel, and Jordan and the modernization of U.S. power projection forces – is \$162.5 billion vs. \$900 million for Iran: *181 times more than Iran*. And this ignores the steady improvement of U.S. power projection forces, new missile defense ships and stealth fighters like the F-35.

(For a full analysis of the patterns in Iranian and other Gulf arms transfers and military expenditures, see Anthony H. Cordesman and Nicholas Harrington, *The Arab Gulf States and Iran: Military Spending, Modernization, and the Shifting Military Balance*, <https://www.csis.org/analysis/arab-gulf-states-and-iran-military-spending-modernization-and-shifting-military-balance>, December 12, 2018.)

The Air Balance Overwhelmingly Favors the Other Sides

This gross imbalance in access to arms imports has been a key reason for Iran's dependence on missiles. From 1980 to today – a period of nearly 40 years – Iran has received only very limited transfers of modern combat aircraft. Iran's most competitive fighters are dated export versions of the MiG-29 and Su-24. Iran has only begun to acquire anything approaching modern surface-to-air and limited missile defenses with the Russian delivery of the first elements of the S-400 system in 2018. The Southern Arab Gulf states received massive transfers of modern aircraft and precision strike munitions and built up major surface-to-air and missile defenses.

Iran currently has no aircraft that can compete with U.S. power projection assets or the first line assets of America's European strategic partners. According to the 2019 edition of the IISS *Military Balance*, the relative fixed wing combat aircraft strength of key regional air forces most likely to engage Iran in late 2018 was:

- **Iran: 336 combat Aircraft: No fully modern, 94 semi-modern.** FTR 184+: 20 F-5B *Freedom Fighter*; 55+ F-5E/F *Tiger II*; 24 F-7M *Airguard*; 43 F-14 *Tomcat*; 36 MiG-29A/U/UB *Fulcrum*; up to 6 *Azarakhsh* (reported) FGA 89: 64 F-4D/E *Phantom II*; 10 *Mirage F-1E*; up to 6 *Saegheh* (reported); up to 7 Su-22M4 *Fitter K*; 3+ Su-22UM-3K *Fitter G*. ATK 39: 29 Su-24MK *Fencer D*; 7 Su-25K *Frogfoot* (status unknown); 3 Su-25UBK *Frogfoot* (status unknown), ISR: 6+ RF-4E *Phantom II**
- **Bahrain: 28 combat Aircraft: 20 fully modern.** 8 F-5E *Tiger II*; 4 F-5F *Tiger II*, FGA 20: 16 F-16C Block 40 *Fighting Falcon*; 4 F-16D Block40 *Fighting Falcon*
- **Iraq: 65 combat capable. 21 fully modern, 19 semi-modern.** FGA 21: 18 F-16C *Fighting Falcon*; 3 F-16D *Fighting Falcon*; ATK 30: 10 L-159A; 1 L-159T1; ε19 Su-25/Su-25K/Su-25UBK *Frogfoot* ISR 10: 2

Cessna AC-208B *Combat Caravan**; 2 SB7L-360 *Seeker*; 6 Beech 350ER *King Air*.

- **Israel: 352 combat capable, 322 fully modern.** FTR 58: 16 F-15A *Eagle*; 6 F-15B *Eagle*; 17 F-15C *Eagle*; 19 F-15D *Eagle*. FGA 264: 25 F-15I *Ra'am*; 78 F-16C *Fighting Falcon*; 49 F-16D *Fighting Falcon*; 98 F-16I *Sufa*; 14 F-35I *Adir* ISR 6 RC-12D *Guardrail* ELINT 4: 1 EC-707; 3 Gulfstream G550 *Shavit* AEW 4: 2 B-707 *Phalcon*; 2 Gulfstream G550 *Eitam* (1 more on order)
- **Kuwait: 66 combat capable, 39 fully modern.** FGA 39: 31 F/A-18C *Hornet*; 8 F/A-18D *Hornet*. TRG 11 *Hawk* Mk64*; 16 EMB-312 *Tucano**
- **Oman: 63 combat capable, 35 fully modern, FGA 35:** 17 F-16C Block 50 *Fighting Falcon*; 6 F-16D Block 50 *Fighting Falcon*; 12 *Typhoon* TRG 4 *Hawk* Mk103*; 8 *Hawk* Mk166; 12 *Hawk* Mk203*; 12 PC-9*
- **Qatar: 18 combat capable, 12 Fully modern.** FGA 12: 9 *Mirage* 2000ED; 3 *Mirage* 2000D. TRG 6 *Alpha Jet**.,
- **Saudi Arabia: 407 combat capable, 266 fully modern, 79 semi-modern.** FTR 81: 56 F-15C *Eagle*; 25 F-15D *Eagle*. FGA 185+: up to 67 F-15S *Eagle* (being upgraded to F-15SA configuration); 47+ F-15SA *Eagle*; 71 *Typhoon*. ATK 67 *Tornado* IDS. ISR 14+: 12 *Tornado* GR1A*; 2+ Beech 350ER *King Air*. AEW&C 7: 5 E-3A *Sentry*; 2 Saab 2000 *Erieye*. ELINT 2: 1 RE-3A; 1 RE-3B. TRG: 24 *Hawk* Mk65* (incl aerobatic team); 16 *Hawk* Mk65A*; 22 *Hawk* Mk165.
- **UAE: 156 combat capable, 78 fully modern, 66 semi-modern.** FGA 137: 54 F-16E Block 60 *Fighting Falcon* (*Desert Eagle*); 24 F-16F Block 60 *Fighting Falcon* (13 to remain in US for trg); 15 *Mirage* 2000-9DAD; 44 *Mirage* 2000-9EAD. ISR 7 *Mirage* 2000 RAD*. SIGINT 1 Global 6000 AEW&C 2 Saab 340 *Erieye*. TRG 12 *Hawk* Mk102*;

These totals do not recognize massive orders of new fighters by Israel and the Arab Gulf states that are now pending while Iran as yet has no backlog of such orders. However, if one compares the total of first line fighters on each side, Iran has none, the Arab Gulf states (less Iraq) have 450, and Israel has 322. The U.S. is actively deploying the F-25, has the F-22, and is building up its inventory of AEGIS missile defense ships.

Iran (and North Korea's) Dependence on Missiles

As is the case with North Korea (and was the case with Iraq during the first Gulf War) missiles offer Iran the ability to strike deep into Arab territory in spite of its gross inferiority in airpower power and precision air strike capability. They have limits, but so do aircraft, and many of the key limits to today's missiles are now vanishing with improvements in missile accuracy and lethality

Missile defenses are also so far limited. Although the Arab states do have some missile defense capability, it is nowhere near the capability of their air defense forces to deal with Iran's limited air forces. Missile strikes have also so far had a major initial impact on populations even if they were only capable of limited point-target lethality in largely random strikes on area targets like cities and population centers.

The U.S. (and Arab and Israeli) focus on the potential nuclear threat from a future nuclear-armed ICBM is valid, but it is only part of the story. It also ignores the fact that any actual Iranian use of nuclear weapons – like a strike by North Korea on outside targets – would probably trigger the destruction of Iran. As Henry Kissinger once remarked in a different context, the threat of committing suicide is a poor deterrent to being murdered.

The U.S. (and Arab and Israeli) focus on the potential nuclear threat from Iran also ignores the fact that even moderately advanced powers with weak airpower already can use missiles as a key part of their mix of deterrence and defense. Iran and North Korea's current ballistic missile systems may lack the mix of accuracy and lethality to hit point targets with anything approaching predictable effectiveness, but they still have deterrent value, political impact, and reinforce the potential threat posed by the risk they may eventually be armed with weapons of mass destruction.

Short and medium range missiles also are relatively easy to disperse, and are still much harder to target and destroy than aircraft tied to an airbase once the missiles have been sheltered, hidden, or are actively mobile. They pose an enduring threat while – as the first Gulf War and invasion of Iraq demonstrated – aircraft can be relatively easy to suppress or destroy once a given side has established air superiority.

At the same time, it is important to note that the open source data on Iran's missile forces are unreliable and contradictory. This not only affects missile numbers, but leads to largely speculative data on nominal performance that ignores the lack of reliable test data, "guesstimates" performance, focuses on the theoretical accuracy of the guidance platform rather than actual missile performance, ignores the lack of any data on the actual warhead, and fails to address major aspects of Iran exercise performance, doctrine, and targeting.

There is no doubt that Iran has a wide range of missile developments. **Figure One** shows an estimate of Iran's range of missile types produced by the CSIS Missile Defense Project. Such estimates have to be somewhat nominal, given the lack of open source access to intelligence data, but it provides a reliable picture of the sheer variety of Iran missile programs.

The IISS Estimate

Some estimates of Iran's actual ballistic missile forces from highly respected sources remain relatively small and only cover the number of launchers – not the numbers of missiles. The 2019 edition of the IISS *Military Balance* provides the following estimate for Iran's major missiles – which are operated by its Islamic Revolutionary Guard Corps Aerospace Force – although these figures do not include some short-range Army systems and long range artillery rockets, coastal defense systems, and efforts to develop ship and submarine-launched versions of the Fateh SRBM:

- **Missile Forces**
 - 1 bde with *Shahab-1/-2*; *Qiam-1*?
 - 1 bn with *Shahab-3*?
- **Missile Launchers**
 - **MRBM • Conventional** up to 50: *Shahab-3* (mobile & silo); some *Ghadr-1* (in test); some *Emad-1* (in test); some *Sajjil-2* (in devt); some *Khorramshahr* (in devt)
 - **SRBM • Conventional** up to 100: some *Fateh 110*; Some *Khalij Fars* (*Fateh 110* mod ASBM); some *Shahab- 1/-2*; some *Qiam-1*; some *Zelzal*
- **UAVs – Unmanned Aerial Vehicles**
 - **CISR • Medium** *Shahed 129*

An IHS Jane's Estimate

An April 2019 estimate by IHS Jane's, another widely respected source, is very different and seems to track better with official background briefings. It states that Iran has a major production facility in Parchin. It warns that many aspects of range and reliability are unclear, but that Iran has exported

missiles to Iraq, Syria, and Yemen and states that Iran is establishing a missile production facility in Syria. It also notes that Iran has supplied Shahab (dubbed 'Burkan' by Houthi forces), Qiam-1 (dubbed 'Burkan-2' and 'Burkan-2H'), and Soumar cruise missiles to the Houthi in Yemen.

The IHS Jane's brief states that Iran's Islamic Revolutionary Guards Corps Air and Space Force (IRGCASF) has the following five brigades:

- 15th Ghaem Missile Brigade, with short-range missiles such as the Fajr
- 5th Ra'ad Missile Brigade equipped with Shahab-3/-4, based in the Karaj area, northwest of Tehran
- 7th Al-Hadid Missile Brigade equipped with Shahab-1 and -2 (Scuds B and C) missiles, based in the Karaj area; and controls the Imam Ali Missile Site in Khorramabad, western Iran. IHS Jane's notes that North Korea supplied Iran with 6-12 Scud-B TELs and up to 200 missiles between 1987 and 1992, and that the US-based Federation for American Scientists estimated in 2008 that Iran possessed between 300 and 400 Shahab-1s and Shahab-2s armed with conventional warheads and distributed among 3-4 battalions.
- 19th Zulfiqar Missile Brigade, equipped with Nazeat and Zelzal short-range missiles, based in the Karaj area
- 23rd Towhid Missile Brigade, based at Khorramabad.

IHS Janes estimates that Iran's short-range missile holdings are separate, and include the Fateh, Shahab-1 and Shahab-2, and enhanced and modified variants of the original Scud-B and Scud-C systems. It also describes five different variants of the Fateh – including anti-ship, anti-radar, and 750 -kilometer range systems. It also reports that China sold up CCS-8 (M-7/Project 8610) short-range, road-mobile, solid-propellant, single-warhead ballistic missiles and 30 TELs based on modifications of the SA-2 to Iran in 1989. It is not clear they are still fully operational, but they have a 190 kg warhead, a 150 km range, and very poor accuracy. Iran calls them the Tondar 69. Some 90 missiles were delivered to Iran in 1992, and a further 110 may have been delivered later.

When it comes to Iran's longer-range missiles, the report indicates that the Nazeat 10 began to be tested in 2014, and is called an MRBM – although its range is unclear. It is felt to be more accurate than the Nazeat – although such reporting seems to focus on the guidance platform rather than missile tests.

IHS Janes indicates that its liquid-fueled Qiam missiles have been mass produced since 2011, and has a range of up to 700 km with a 650 kg payload. It also cites three different versions of the liquid-fueled Shahab missile – which is derived from the North Korean No Dong, and exceeds the 1,000-kilometer range limit set by the UN. These versions include the Shahab-3A (Ghadr 101) with a range of 1,500-1,800 km, the Ghadr-1 with a range of 1,800 km, and Shahab-3B (Ghadr 110) with a range of 2,000-2,500 km.

The Shahab is being replaced or supplemented by the more accurate Qadr F with a range of 1,600 km, the Qadr H with a range of 2,000 km and improved multiple re-entry vehicle, and the Qadr S with a range of 2,000 km with cluster munitions warhead.

The Khorramshar is said to still be in the test phase, and similar to the North Korean Hwasong-10 (KN-07) liquid-fueled missile with a maximum range of 2,000 km. The Seiji-2 is estimated to be another longer-range solid fueled system with a range of 2,200 km with a 750 kg warhead. A third system called the Emad may be a modification of the Qadr and to have started delivery in

2016. Finally, Iran seems to be developing an ICBM called the Simorgh (Safir-2) out of its Simorgh satellite launch system.

According to work by Jeffery Lewis of NTI, Iran also displayed new 1,000-km long-range ballistic missile called the *Dezful* in February 2019. Lewis notes that Major General Mohammad Ali Jafar, a former commander of the IRGC, called the missile as “an answer to Westerners ... who think they can stop us from reaching our goals through sanctions and threats,” and state that its purpose was to “to protect our nation and the oppressed and downtrodden nations in the region that may ask for help from the Islamic Republic.”¹

Peering Through the Fog

It should be stressed here that open-source estimates are heavily dependent on trying to interpret Iranian data that are deliberately designed to confuse and often to exaggerate Iran capabilities. The data focuses on the maximum range based on a nominal payload which is often never fully specified or defined, and not actual payload or test data. There are no reliable data on actual performance, there almost always seem to be too few actual tests to properly establish a derived aim point level of accuracy, and it is generally assumed that the warhead is either unitary high explosives or cluster munitions without terminal guidance or missile defense countermeasures.

Just as Iran often deliberately exaggerates the size and nature of its military exercises, it exaggerates its missile capabilities. It has issued faked videos of salvo launches, and images of its ability to use missiles to target airfields. It also plays name games with its missiles to exaggerate or confuse the nature of its development programs. This is all too "fair" in hybrid warfare, but it also means that any Iranian or outside open source reports on Iranian missile performance need to be approached with extreme caution.

That said, Iran has conducted enough credible tests, and transferred enough missiles and missile technology to third parties like the Houthi in Yemen, to show its missile capabilities are still very real. It is building on well-established Russian, Chinese, and North Korean missile technology, and a purchasing and espionage network it has steadily refined since the Iran-Iraq War. US, Israeli, and other experts do report major improvement in Iranian missile design and manufacturing capability, and Iranian shorter and medium range systems do seem to be relatively rugged in a the few known field tests where the data seem moderately convincing.

Iran's Current Ballistic and Cruise Missiles and Warfighting Capability

One needs to be cautious about any effort to go from these uncertainties to making any broader judgments about Iran's current ability to use its ballistic missiles, cruise missiles, and drones to deter, influence/shape events, and actually fight major wars.

Iranian Foreign Minister Mohammad Zarif said on June 1, 2019 that Iran had the right to defend itself against U.S. aggression and stated that it would use “whatever missiles it wants” to deal with the increased American military presence in the region. At least in the near term, however, Iran's ability to use its missile capabilities in actual fighting are highly scenario-dependent. Iran does not to possess of a nuclear-armed missile force, and its warfighting abilities to launch a highly lethal major attack with precision guided and conventionally armed systems.

Iran's forces are evolving, but most current Iranian missiles lack the necessary accuracy and lethality. Even large salvos of such missiles would probably do little or no damage to key point targets and hit well outside of the blast range of the missile warhead. In broad terms, the real world

accuracy/reliability of any missile without fully functional GPS guidance or terminal homing is so limited that only luck – the equivalent of a "magic bullet" – will allow it to hit a critical point in a major industrial facility, air or other military base, port, desalination plant or other area targets.

In contrast, Iran faces Arab Gulf and Israeli air forces with precision strike air launched missiles with ranges over 100 kilometers like the Storm Shadow, and U.S. stealth aircraft and cruise missiles. As long as Iran is reliant on older ballistic missile technology without precision strike capability, it would be far more vulnerable to air-delivered precision counterstrikes than its potential target.

As a result, Iran best current tactics and strategic options are to use its missiles as a retaliatory deterrent, keeping them as an active threat that it can use to deter or limit U.S., Arab, and/or Israeli first use of precision strikes. If Iran did use missiles offensively, it would probably seek to use them in asymmetric or hybrid attacks that would limit counterattacks and counter-escalation.

Iran has several such options. Iran could seek to use a third party as it has the Houthis – transfers which might include the Assad regime or Hezbollah – to limit the risk or counter escalation. It might also conduct limited launches against key Gulf petroleum facilities, tanker loading ports, or other critical targets where sporadic launches might avoid triggering a general response but be enough to force a shutdown of such a facility or halt tanker and shipping movements and loadings. Firing at an airport or center of government might be another case. Such efforts to decouple any use of a ballistic missile from retaliation would be uncertain at best, but demonstrative escalation could also occur against a non-target.

Large-scale retaliation to U.S., Arab, and/or Israeli use of precision strikes is also a more credible option. Launching as many retaliatory missile strikes as possible in the face of a major threat to the regime, or volleys against cities and key bases in the face of more limited outside attacks, might not achieve high levels of critical lethality, but it seems unlikely that Iran's regime would accept a passive defeat or fail to try to use more focused retaliation to the extent it could.

In short, the large-scale use of Iran's *present* missile forces seems likely to be sufficiently limited in its destructive effect so that it would be more provocative than either a deterrent or defense. The vastly superior current strike capabilities of Iran's opponents –their desire to act before Iran can create more effective missile forces and are defenses seems likely to lead to a scale of U.S., Arab Gulf and/or Israeli conventional precision strike retaliation that cripples Iran's economy and military forces for years, that might destroy or force the collapse of the current regime, and even one lead to Iran's occupation.

Iran's Coming Conventional Precision Strike Forces

The nature of the Iranian missile threat is already changing, however, in ways that will radically increase the value of conventional Iranian missile strikes. Once again, the details of these efforts are unclear and open sources are in conflict, but the broad trends are not controversial. Respected experts like Uzi Rubin believe Iran is already in the process of deploying conventionally armed missiles accurate enough to hit critical military and civil point targets.

Iran may now be claiming levels of precise accuracy, and countermeasure capabilities against missile defenses that it does not yet have. However, many experts feel that Iran will develop a far more effective mix of forces over the next few years. Here, the U.S., Israel, and Arab strategic partners must consider the following key force changes:

- ***Precision strike conventionally armed ballistic missiles.*** Iran has already claimed to have made extensive tests of ballistic missiles like the "Fateh 313" with much more accurate guidance and a range of 500 km. Some sources also claim that a version of the Fateh has a satellite navigation system-assisted inertial navigation system guidance package, and an imaging infrared sensor which could give it a capability to hit moving targets, including ships. While sources vary, Iran seems to have claimed that its Emad had a CEP of only 500 meters after tests in October 2015 – although this claim may refer only to the accuracy guidance platform and not the entire system. Work by Uzi Rubin also suggests that Iran may have a much broader family of precision strike images.

It currently is unclear how much real-world progress Iran has made, what types of improved guidance it is seeking to deploy, and what kind of ballistic missile force it is seeking to evolve. What is clear is that even a relatively large conventional warhead requires accuracy in meters to tens of meters to destroy many critical targets, and that accuracy/reliability and terminal guidance are the critical aspects of conventional missile lethality because of the inverse cube limits to improving blast lethality. The U.S. has also demonstrated how damaging even relatively small UCAV warheads and laser-guided bomb warheads can be.

The Gulf is filled with high value components and targets where precision-strike systems – whether a bomb, cruise missile, or ballistic missile – could do critical damage with months to years of long-lead replacement and repair time. These include key C4I/battle management, IS&R, and sensor/radar links. They also include a wide variety of key petroleum, port, water and desalination, electric power, and other civilian facilities, and a major precision strike could potentially do the same level of damage in days and hours that took the U.S. weeks in the 1991 attacks on Iraq.

- ***Countermeasure equipped ballistic missiles.*** Iran has already claimed to have some countermeasure capability and its booster could deliver relatively large warheads with such measures at long ranges.
- ***Firing older missile types as cover and to saturate defenses.*** Iran could retain large numbers of older missiles in static disperse launch sites and try to saturate missile defenses with volleys of older systems while it launches more modern and accurate systems.
- ***Mixes of cruise missiles and UCAVs.*** Iran already is developing cruise missiles and has long deployed drones and unmanned combat aerial vehicles. Its first major family of drones was called the Mohajer, and Iran has experimented in arming the Mohajer with anti-aircraft missiles. It transferred UAVs to the Hezbollah as early as 2005, and began to employ light crew-portable surveillance UAVs like the Yasir in Iraq in 2009 and the Ababil in 2014. It has also deployed a 100 km range jamming drone called the Siraf.²

Iran current level of progress is unclear, and it has made many ambitious and sometimes conflicting or duplicative claims. It does seem to have recovered major parts of a U.S. stealth UAV called the RQ-170 Sentinel in 2011. Iran claims to have tested a copy in October 2016 that can carry four precision-guided bombs, but its pylons and other features make it clear that it is not a true stealth system.

Iran claims to have developed a UCAV called the Shahid 129 – which some sources have called similar to the U.S. Predator or Israeli Hermes 450 – and flew it against Israel in

2016. Iran claims it has a range of up to 1,600 kilometers, a 24-hour endurance, and a payload of up to eight Sadid-1 missiles (similar to the Israeli Spike LR). Iran also has said it has an IS&R drone called the Karar that has a 965 km range that can carry a small bomb. Iran's Ra'ad-85 is claimed to be a suicide attack drone.

Iran also seems to have modified the Russian Raduga Kh-55 cruise missiles to create a mobile ground-based system called the "Soumar" family of cruise missiles). with claims it could be modified to have a range as long as 3,000 km. Iran's Defence Minister Amir Hatami and the Commander of the Islamic Revolutionary Guards Corps Aerospace Force Brigadier General Amir Ali Hajizadeh announced a new generation of the Soumar long-range ground-to-ground cruise missile called the Hovizeh (Hoveyzeh) –and Iran provided video footage of launch – on February 2, 2019.

Iran claimed on February 28, 2019 to have tested a submarine-launched cruise missile, and released footage of its Ghadir-class submarines firing a new Jask-2 submarine-launched anti-ship cruise missile during a major exercise in the north of the Persian Gulf and in the Gulf of Oman. Iran has also claimed to be deploying Qased 3 ("Messenger") air-launched cruise missiles on its F-4s.

Both its largest UCAVs and cruise missiles like the Soumar could potentially have combination of accuracy and lethality that could destroy key components of critical military and civil systems in the same way as precision-guided ballistic missiles and become similar "weapons of mass effectiveness."

In addition, Iran has developed anti-ship missiles like the Zafar, Nasr, Noor, and Ghader (Qader) that have related technologies.

This mix of cruise missiles and UCAVs creates the possibility of developing mixes of precision guided ballistic and cruise missiles, and UCAVs that could greatly complicate any missile defense effort. Iran could use its systems with high range-payloads to fly evasive and unpredictable attack patterns rather than achieve a maximum range. It could also combine low fliers with ballistic missile attacks that mixed precision guided modern missiles and older, less accurate missiles as decoys. UCAVs can also fly profiles that could make it easier to deny attribution to future Iranian precision strikes, and/or be transferred to other countries and non-state actors in ways that help Iran avoid taking responsibility for given attacks.

- ***Precision targeting inventories.*** Iran already has some satellite and UAV targeting capability. Iran can almost certainly already carry out its missile launches with military grade GPS coordinates. Given the uncertain level of Gulf Arab security and dependence on foreign workers, it can use field agents and cellphone size devices to get precise GPS coordinates and cell phone images of the exact location of critical facilities and major components for target purposes – possibly using small drones as well. Many targeting problems that existed in the past could be eliminated.
- ***Added missile mobility and shelters.*** Improved boosters and reliability can make it far easier to disperse and support Iran's ballistic missiles. Creating a "shell game" set of disperse shelters and improved mobile missile launchers is a relatively cheap option.
- ***Russian or Chinese sales of advanced combat aircraft.*** Russia or China may see Iran as a more credible strategic option as its missile forces improve and/or be willing to sell more

advanced fighters and air systems for other reasons as part of their strategic competition with the U.S.

- ***Other hybrid or asymmetric attack modes.*** Iran's improving strike capabilities will interact with its ability to threaten shipping in the Gulf and through the Strait of Hormuz, and support other states and non-state actors by creating a far more serious threat of retaliation if Arab states, Israel, or the U.S. escalate or threaten Iran for such actions.
- ***Deployment of the S400 and S500 Russian air and missile defense systems.*** Iran already is deploying its first major improvement in surface-to-air and missile defense systems in decades – with the exception of small numbers of a Russian very short-range defense system called the 299K331 Tor-M1 (SA-15 Gauntlet). It may acquire the S500 with far more advanced missile defense capabilities as well. Over time, this could sharply degrade the present advantage the U.S., Israel, and Arab states have in air combat and precision strike capability.
- ***Transfers to other states and non-state actors.*** Iran has already transferred missiles to the Houthis in Yemen, Syrian government forces, and the Hezbollah in Lebanon, as well as rockets to Palestinian forces in Gaza. All of these weapons, technologies, and tactics can be used in making such transfers in the future, and reducing/avoiding Iranian accountability for such attacks.

There is no current way to predict how many of these options Iran will execute or how well it will execute them. It seems highly unlikely, however, that Iran will fail to take advantage of many – if not all – of these options. It is also clear that powers like North Korea will have similar opportunities. For all the present concern with nuclear-armed missiles – and weapons of mass destructiveness – it may well be conventional armed precision missiles that become weapons of mass effectiveness that come to dominate both the Iranian and North Korean threat.

The Limits to Iran's Nuclear Missile Options: Threatening Suicide as a Deterrent to Being Murdered

Finally, it is important to keep Iran's options for deploying nuclear-armed missiles in careful perspective. For all the present focus on Iran's potential nuclear missile threat, it is important to note that such a threat has critical limits. Even if Iran does eventually deploy nuclear-armed missiles, these are only clearly valuable as a deterrent threat and that deterrent value only exist up to the point where such weapons are actually employed. They could all too easily become a disaster for Iran if it ever used them.

Once such Iranian weapons are used – and possibly even if they are only used in the most limited demonstrative way – Iran is likely to trigger a massive all-out attack on Iran. Moreover, even the suspicion that Iran was actively preparing for such an attack might trigger a massive preemptive response.

No one can really predict how each side will behave in a conflict so inherently irrational because of its sheer unpredictability and destructiveness. However, Iran's actual use of nuclear weapons against U.S. and allied forces in the Gulf can too easily lead to a response that makes such any Iranian action border on regime suicide.

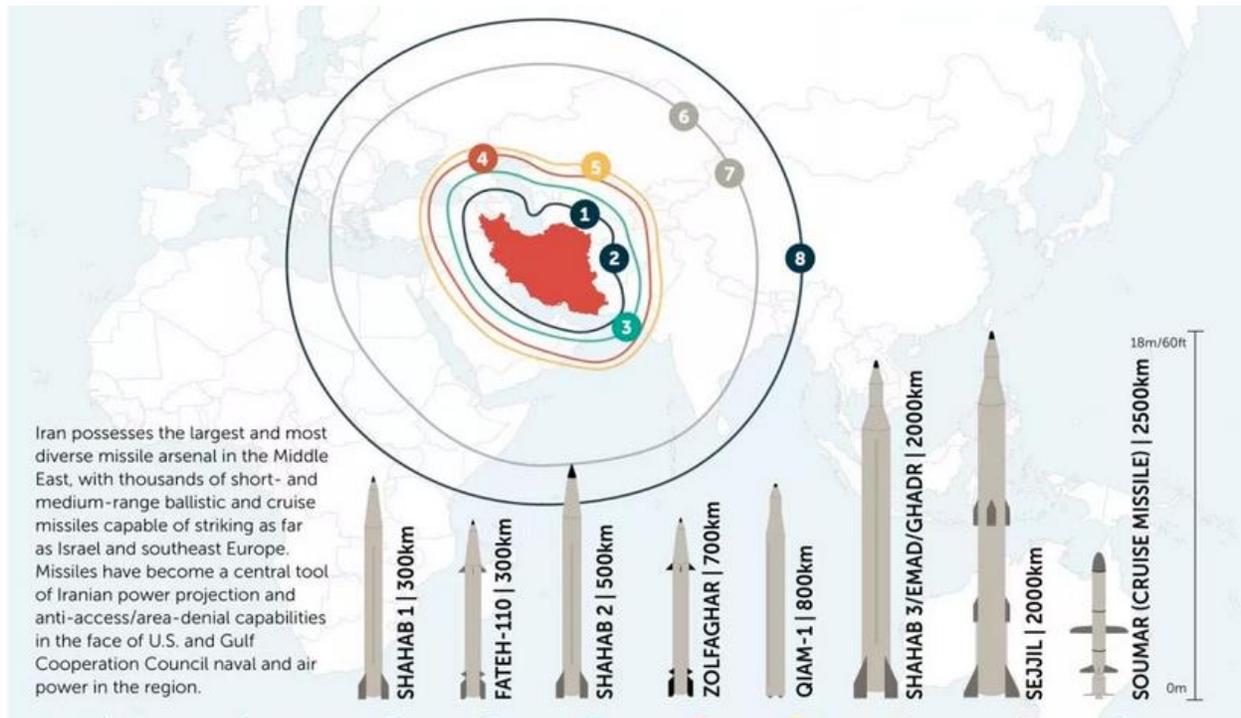
Iran might also make demonstrative or terror-related use of other forms of weapons of mass destruction. Iran is a self-acknowledged chemical weapons power under the terms of the Chemical

Weapons Convention, and has the technical based to create advanced biological weapons. Ballistic missiles are scarcely ideal ways to deliver such weapons, and the political and escalatory consequences might well be far worse than any advantages Iran can gain.

However, slow and low fliers like cruise missiles and UAVs offer far more effective forms of line source delivery of CBW agents and might well be harder to detect or clearly assign to Iran. Moreover, the history of military escalation is not particularly rational on the part of any of the sides involved. Syria has already shown that using chemical weapons can lead to "red lines" that vanish into the sand, but a future such Iranian chemical attack might trigger an all-out U.S., Gulf Arab, or Israeli response.

At the same time, such an Iranian action might conceivably lead to a state of panic in the targeted area. Even firing a missile with a non-functioning chemical warhead could have a major terror or deterrent effect. This kind of option involves so many risks and uncertainties that it seems more likely to be only used by a more extreme regime state like North Korea, but cannot be totally dismissed.

Figure One: Iran's Ballistic Missiles



Missile	Class	Range	News
Safir	SLV	350 km altitude	Operational
Khorramshahr	MRBM	2,000 km	In Development
Qiam-1	SRBM	700-800 km	Operational
Shahab-1	SRBM	285-330 km	Operational
Simorgh	SLV	500 km altitude	In Development
Koksan M1978	Artillery	40-60 km	Operational
Zolfaghar	SRBM	700 km	Operational
Emad (Shahab-3 Variant)	MRBM	1,700 km	In Development
Sejjil	MRBM	2,000 km	Operational
Shahab 2 (Scud C-Variant)	SRBM	500 km	Operational
Shahab-3	MRBM	1,300 km	Operational
Ghadr 1 (Shahab-3 Variant)	MRBM	1,950 km	In Development
Fateh-110	SRBM	200-300 km	Operational
Tondar 69	SRBM	150 km	Operational
Soumar	Cruise Missile	2,000-3,000 km	Operational (presumed)
Ra'ad	Cruise Missile	150 km	Operational

Source: CSIS Missile Defense Project, <https://missilethreat.csis.org/country/iran/>, accessed 3.6.19

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¹ Jeffrey Lewis "Middle East Missile Mania: It's Not Just Iran," NTI, <https://www.nti.org/analysis/articles/middle-east-missile-mania-its-not-just-iran/>, May 28, 2019.

² For an interesting analysis from an Iranian point of view, see Naveed Ahmad, *The Advent of Drones: Iran's Weapon of Choice*, Rasanah, International Institute for Iranian Studies, May 2019. This analysis draws on his description of Iran's efforts.