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Iran's Extensive Cruise Missile Program Requires U.S. Action

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KEY TAKEAWAYS

The recent Iranian attack on Saudi Arabia's largest oil facility and one of its largest oil fields affected 5 percent of the world's oil supply.

It also reflects an underappreciated evolution and growth in Iran's air power and military prowess in the Middle East.

The threat of Iranian cruise missiles and their proliferation merit immediate U.S. attention and action to protect American forces and advance U.S. interests.

In an unprecedented attack in September 2019, Iran struck the expansive Saudi oil processing facility at Abqaiq and the oil fields at Khurais with armed drones and cruise missiles. The attack cut Saudi oil production by 50 percent.[1]

The strike on Saudi Arabia's largest oil facility and one of its largest oil fields affected 5 percent of the world's oil supply.[2] It also shook global energy markets, caused a spike in oil prices, and significantly affected the world's spare oil capacity.

It was a significant demonstration of Iranian military force against an important regional rival that had the potential to escalate into a broader conflict in the Middle East with untold consequences. There has been much attention placed on Iran's missile programs, especially its space launch vehicles and ballistic missiles, but the use of cruise missiles—alongside drones— in this attack reflects an underappreciated

evolution and growth in Iran's air power and military prowess in the Middle East.

It also raises new questions about cruise missile defenses, especially U.S. capabilities and capacity.

The Saudi strike's apparent success will likely lead Iran to spend more time, effort, and money on its cruise missile programs, increasing the air and military threat of Iran, its allies, and proxies, shifting the military balance, and further undermining regional stability. Indeed, Iran's proxies and allies, the Houthis of Yemen and the terrorist group Hezbollah of Lebanon, have seemingly successfully used Iranian-made or -supplied cruise missiles in conflicts in the Middle East in recent years, most notably against Israel and Saudi Arabia. Considering rising tensions with Iran, U.S. forces deployed to the Middle East or sailing Middle Eastern waters also face a growing threat from Iranian cruise missiles wielded by Iran, its allies, and proxies.

To address the current—and future—Iranian cruise missile threat, the Trump Administration should ensure a positive military balance against Iran in the Middle East and continue the maximum pressure campaign against Iran to limit funding for Tehran's military programs, including cruise missiles. It should also continue and intensify work with key Middle Eastern allies and partners to blunt the Iranian cruise missile threat and seek avenues to continue the arms sales ban on Iran currently found in United Nations Security Council Resolution (UNSCR) 2231, which expires in October 2020.

In addition, Congress should hold open- and closed-door hearings on the U.S. military's ability to defend U.S. forces against the growing Iranian cruise missile threat in the Middle East and provide adequate funds for U.S. forces to procure, develop, and field the necessary number of cruise missile defense systems in the most expeditious and cost-effective manner possible.

Cruise Missiles: The Weapon

The idea of a cruise missile can be, arguably, traced back to before World War I, but the German V1 program and its use in the latter years of World War II established the cruise missile as a viable military weapon.[3] While definitions can vary, today, according to the Department of Defense, a cruise missile is a "guided and powered missile that flies at constant speed for the majority of its route and relies upon aerodynamic forces for lift."[4]

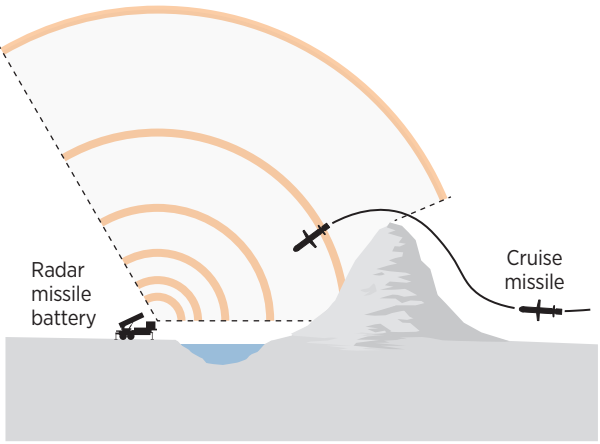
Cruise missiles are often broadly categorized into land-attack cruise missiles (LACMs) or anti-ship cruise missiles (ASCMs), but often a single cruise missile can accomplish both missions. Cruise missiles can be launched

FIGURE 1

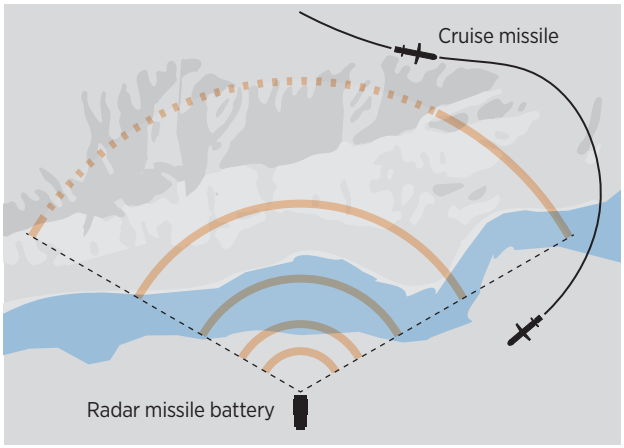
Cruise Missiles Pose Challenge to Radar Detection

Modern radar defense systems have a wide detection "cone," but the system must be oriented toward an incoming missile and have a clear line of sight to detect it.

SIDE VIEW
A low-observable cruise missile can avoid radar acquisition by flying at low altitudes behind terrain, reducing response time.



OVERHEAD VIEW
A cruise missile can also fly behind terrain to avoid a radar signal, evading detection.



SOURCE: Heritage Foundation research.

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from land, at sea, or in the air from a variety of stationary or mobile launch platforms. For instance, cruise missiles can be launched from an aircraft as air-launched cruise missiles (ALCMs). They can also be launched from the ground as ground-launched cruise missiles (GLCMs) or the shoreline as coastal-defense cruise missiles (CDCMs). Last, cruise missiles can be launched from the sea from boats, ships, or submarines as sea-launched cruise missiles (SLCMs).

Often powered by small jet engines, cruise missiles can fly at both subsonic and supersonic speeds, using a number of navigational aids to find their designated targets, including radar, inertial navigation, global positioning, terrain contour matching systems, or digital scene matching area correlation. Cruise missiles confer some distinct advantages to a military force. These include launch platform mobility; high-accuracy, low-level flight; and low-observability. A cruise missile can also be programmed to fly evasively en route to its target. These performance qualities make the cruise missile difficult to detect and, therefore, difficult to defend against as well.

Indeed, cruise missiles are often sought after because they may be able to penetrate air defenses when a mission with manned aircraft might prove impractical, risky, or costly.[5] They also can be advantageous over aircraft in that they may have fewer maintenance, training, and logistics costs.[6]

Cruise missiles can also carry a number of conventional and unconventional payloads, including high explosives, sub-munitions, and weapons of mass destruction (WMD), making them highly versatile offensive weapons. It should be noted that cruise missiles are not without disadvantages in comparison to other types of air power, such as aircraft and ballistic missiles. Shortcomings include a potentially decreased range and a lower speed over the ground toward its target, which makes a cruise missile vulnerable to capable air defenses.

Alongside ballistic missiles, many countries see cruise missiles as cost-effective weapons, as symbols of scientific and technological achievement, and, of course, as a manifestation of national prestige and power.[7] A robust missile arsenal can also be used as an instrument of political and military deterrence or coercion. A cruise missile, with its potential for agility, versatility, and survivability, can augment a country's military might and power projection, diversifying the air and missile threat a potential opponent must defend against.

As demonstrated by recent events in Saudi Arabia, it is clear that Iran or a proxy is attempting or making use of the potential advantages of cruise missiles from a number of perspectives, including the political, military, economic, and informational. This situation has affected, and will likely continue to effect, U.S. and allied regional interests.

Iranian Ambitions and Cruise Missiles

Iran has the largest missile arsenal in the Middle East.[8] Its missile arsenal projects power and influence, compensating for Iran's lack of conventional air power such as advanced fixed and rotary wing aircraft. Its missile program has also come to play a central role in advancing Iran's hegemonic ambitions in the Middle East. Indeed, according to the 2018 National Defense Strategy of the United States:

> In the Middle East, Iran is competing with its neighbors, asserting an arc of influence and instability while vying for regional hegemony, using state-sponsored terrorist activities, a growing network of proxies, and its missile program to achieve its objectives.[9]

The Pentagon's 2019 Missile Defense Review expresses it this way: "Iran views U.S. influence in the Middle East as the foremost barrier to its goal of becoming the dominant power in that region. One of Iran's primary tools of coercion and force projection is its missile arsenal, which is characterized by increasing numbers."[10] It continues, noting the importance of missile programs to the Iranian regime, as well as its growing threat: "In its quest for hegemony in the Middle East, Iran has devoted major resources to develop and deploy a spectrum of missile capabilities, which...threaten U.S. allies, partners, and interests in the Middle East and beyond."[11]

Lieutenant General Robert P. Ashley, Director of the Defense Intelligence Agency (DIA), testified before Congress in 2018 about Iran's cruise missiles: "Iran is pursuing long-range, precision land-attack cruise missiles as well as development of more powerful space launch vehicles—boosters that would be capable of ICBM [intercontinental ballistic missile] ranges if configured for that purpose."[12]

The 2019 Missile Defense Review also noted the rapidly evolving and increasing threat of Iranian missiles to U.S. forces in the Middle East and that of Middle Eastern allies and partners: "Iran is accelerating efforts to field missiles capable of threatening deployed U.S. forces, allies, and partners. It is continuing to develop more sophisticated missiles with improved accuracy, range, and lethality."[13] These technological developments are meant to not only introduce a new threat into the region, but to improve the operational and deterrent value of Iran's military and missile arsenal against potential opponents.[14]

Finally, the Director of the DIA highlighted to Congress in 2018 that cruise missiles, among other Iranian weapons systems, are a threat to freedom of navigation in the Persian Gulf, the Strait of Hormuz, and the Gulf of Oman:

> Both Iran's regular Navy and Islamic Revolutionary Guard Corps Navy will field increasingly lethal platforms and weapons—including more advanced mines, small submarines, fast-attack craft, and ship- and shore-based anti-ship cruise missiles—which further complicate U.S. freedom of navigation throughout Iran's littoral.[15]

It is clear that Iran has embraced cruise missiles as part of its broader political and military strategy to enhance its asymmetric military might aimed at advancing Tehran's geostrategic objectives in the Middle East. Indeed, Iran reportedly introduced at least two new GLCMs and one SLCM this year alone. While it is unclear whether these new missiles are

operational, it is clear Iran is committed to fielding a formidable cruise missile arsenal.

Iran's and Proxy's Cruise Missiles

Though Iran has purchased Chinese missiles going back to the 1980s, Iran's indigenous cruise missile program appears to be a relatively recent development, originating with their acquisition of a Russian cruise missile almost 20 years ago.[16] Iran appears to have several models of cruise missiles either in development or in use, alongside its ballistic missile program.

This section addresses Iran's better-known cruise missiles. Open-source information on Iran's cruise missiles is limited, and specifics vary widely. It should be noted that some of information included herein is from official Iranian sources and, therefore, could include misinformation or disinformation directed toward a number of audiences, including potential enemies.

Soumar. The long-range Soumar, introduced in 2015, is perhaps Iran's best-known cruise missile.[17] This ground-based Iranian LACM is likely a variant of the Iranian Meshkat cruise missile, which Tehran unveiled in 2012 as its first land-attack cruise missile.[18] The Soumar, like the Meshkat, could be based on the Russian ALCM, the AS-15 KENT, also known as the Kh-55.[19] Ukraine reportedly sold several of the nuclear-capable Kh-55 to Iran in 2001.[20]

The Soumar has a reported range of 2,000 kilometers.[21] Other sources estimate a range as great as 3,000 kilometers.[22] In either case, using this missile, Iran could potentially strike targets across the Middle East, South Asia, and into Eastern/Southern Europe.[23] Iranian reports claim the Soumar is accurate to within 50 meters of its predetermined target.[24] Iranian officials have also reportedly referred to the Soumar as the "long-arm of the Armed Forces of the Islamic Republic of Iran."[25]

Tehran also asserts that it could develop "alternate launch modes for this missile, including aircraft or naval platforms."[26] This could apply to the Meshkat cruise missile as well, though the Meshkat has likely been superseded by the Soumar.[27]

Hoveizeh. Iran unveiled a new long-range cruise missile, the Hoveizeh, in February 2019, coinciding with the anniversary of the 1979 Iranian Islamic Revolution.[28] Iran claims that the new cruise missile has a range of 1,300 kilometers and is a variant of the Soumar.[29] The Hoveizeh can reportedly be fired from a mobile launcher.[30]

Mobin. The newest Iranian cruise missile, which was reportedly unveiled at International Aviation and Space Salon in Moscow in August 2019, has a reported range of 450 kilometers, a speed of 900 kilometers per hour, and

TABLE 1

Iranian and Proxy Land-Attack Cruise Missiles

Name	Range (km)
Mobin	450
Ya Ali	700
Quds-1	700–1,350
Hoveizeh	1,300
Soumar	2,000

SOURCES: Heritage Foundation research.

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TABLE 2

Iranian Anti-Ship Cruise Missiles

Name	Range (km)
Nasr	30
Jask-2	35
Noor	120
Ghader	200
Ghadir	300

SOURCES: Heritage Foundation research.

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a maximum altitude of 45,000 feet, according to Iranian sources.[31] It also reportedly carries a warhead of up to 120 kilograms and has a low-radar cross-section.[32]

Ya Ali. Unveiled in 2014, the shorter-range Ya Ali LACM has a reported range of 700 kilometers.[33] It reportedly can be both ground- and air-launched.[34] While Iran claims not to have transferred cruise missiles to the Houthi rebels in Yemen in violation of U.N. Security Council Resolutions 2216 and 2456,[35] these cruise missiles have reportedly been used by the Houthi rebels in its cruise missile attacks on Saudi Arabia during the ongoing conflict.[36]

Quds-1. This LACM is associated with the Houthi rebels and almost certainly has ties to Iran, though, for understandable reasons, Tehran does not acknowledge this. Some analysts believe that the Houthi Quds-1 GLCM is a

variant or hybrid of the Ya Ali or the Soumar-class of cruise missile, though not everyone agrees.[37] Public sources have not definitively identified the range of the Quds-1, but some analysts claim it has a range similar to the Ya Ali at 700 kilometers, while others estimate it to have a range of 1,350 kilometers or somewhere between the range of a Soumar and the Ya Ali.[38]

Nasr. Beyond its growing arsenal of LACMs, Iran also has long developed and fielded ASCMs, which threaten military and commercial shipping on important waterways in the Middle East, such as the Persian Gulf, the Strait of Hormuz, and the Gulf of Oman. The Nasr is a short-range ASCM based on the Chinese C-704 cruise missile with a range of 30 kilometers.[39] It has been deployed on ship and patrol boats and possibly helicopters.[40] Iran may also attempt to equip its F-4 fighter aircraft with Nasr ASCM to create additional maritime strike capability.[41]

Jask-2. In February 2019, Iran launched a cruise missile from a submarine for the first time during a naval exercise near the strategic Strait of Hormuz, a chokepoint for a good portion of the world's oil supply.[42] Iran claimed the ASCM was launched from a Ghadir-class mini-submarine.[43] Iranian media claims that the Tareq-class and new Fateh-class conventional submarines can also fire this anti-ship SLCM.[44] Iranian media said the new, possibly designated, Jask-2 cruise missile was an upgraded version of the Nasr-1 ASCM.[45] It reportedly has a range of 35 kilometers.[46]

Noor. Iran also has a medium-range ship-based and land-based ASCM, the Noor.[47] The land-based CDCM version is launched from a mobile transporter.[48] Its range is estimated at 120 kilometers.[49]The Islamic Revolutionary Guard Corps (IRGC) Navy is reportedly equipping helicopters with Noor ASCMs.[50] Both versions of the Noor are believed to be a version of the Chinese C-802.[51]

Ghader/Ghadir. These longer-range anti-ship CDCMs are also derivatives of the Chinese C-802 cruise missile program, which Iran produces domestically.[52] They have a range of 200 kilometers and 300 kilometers, respectively.[53] According to the Office of Naval Intelligence (ONI), Iran is continuing to develop its CDCM program.[54] These missiles allow Iran to hold nearly the entirety of the Persian Gulf and Gulf of Oman at risk, serving as an important element of Iran's anti-access/area-denial strategy.[55]

In addition, the ONI believes that beyond submarine-launched cruise missiles, Tehran is also working to develop a supersonic ASCM and may be negotiating to acquire the Russian SS-N-26 Yakhont CDCM.[56] Iran may also be developing an ALCM, the Ghassed-3, for the F-4 fighter.[57] Both the Islamic Republic of Iran Navy and the IRGC Navy possess ASCMs. Similarly, LACMs are also fielded by both the Islamic Republic of Iran Army and the IRGC land forces.[58]

While the *Artesh* (conventional military) and *Pasdaran* or *Sepah* (IRGC) both possess cruise missiles, an Iranian media source with ties to the IRGC reports that the majority of Soumar cruise missiles will be transferred to the IRGC.[59] It should be noted that the U.S. State Department designated the IRGC a Foreign Terrorist Organization in 2019.[60]

Iran seemingly abides by a voluntary, self-imposed limit of 2,000 kilometers on the range of its missile arsenal, saying it is sufficient for its self-defense for the moment.[61] It is arguable as to whether this range is excessive to the threat Iran faces—or even factual—but what should be noted is that placing Iranian missiles in Lebanon or Yemen would extend the threat ring that Iranian cruise missiles pose.

All of Iran's missile production occurs under the umbrella of the Aerospace Industries Organization (AIO).[62] The AIO is an Iranian state-owned corporation that oversees the military and civilian aerospace industry in Iran.[63] Potentially important to AIO is the assistance of foreign entities. While the transfer of the Kh-55 missile from Ukraine in 2001 has already been mentioned, Iran appears to be receiving support from foreigners, which serves the purpose of potentially quickly advancing its cruise missile research, development, and deployment.

China, also previously mentioned, provided significant support to Iran with the transfer of missile technology, such as the Silkworm in the 1980s, and later the C-700 and C-800 cruise missile series in the 1990s, which provided Tehran with a domestic cruise missile production capability.[64] That cruise missile cooperation with China may very well continue to this day. Although it does not specify cruise missiles, according to an August 2019 State Department report to Congress, "In April 2018, the United States imposed sanctions against seven Chinese entities pursuant to the INKSNA [Iran, North Korea, and Syria Nonproliferation Act] for transferring missile technology to Iran."[65] Indeed, there has been significant discussion about whether Chinese proliferation to Iran of cruise missile technology, including guidance systems, could have played a role in the success of the Iranian cruise missile attack in Saudi Arabia in September.[66]

Another telling element of Iran's missile program is that, according to the DIA, "Iran maintains the largest underground facility (UGF) program in the Middle East and primarily uses this capability to protect and conceal many aspects of its missile program."[67] It is unclear if cruise missile programs are part of Iran's UGF program.

While unmanned combat aerial vehicles (UCAVs)—or armed drones—are not technically cruise missiles, they can have capabilities similar to cruise missiles and can either substitute for, or augment, a cruise missile force,

especially when outfitted with an integrated conventional or unconventional warhead.

Although not the subject of this paper, it is worth mentioning that Iran does have a number of UCAVs that can arguably be used in a cruise-missile role, such as that reportedly seen in the Abqaiq and Khurais attacks and used routinely by the Houthi rebels in Yemen against domestic and international targets.[68]

Iranian and Proxy Cruise Missiles in Action

Iran is producing a range of cruise missiles not only for use in offensive and defensive military operations, but also to support its allies and proxies—which also work to advance Iranian political–military interests. Iranian cruise missiles have seen action in several parts of the Middle East in military operations and exercises, stretching from Lebanon to Yemen. With this in mind, let us look at Iran's use and proliferation of its cruise missiles in support of Iran's regional military operations, the international terrorist group Hezbollah, and the Houthi rebels (its proxy in Yemen).

Iran. While Iran insists that the drone and cruise missile attacks on Abqaiq and Khurais were the work of their ally and proxy, the Houthis, reporting claims that the drones and cruise missiles were launched from north of the targets, including Iranian territory or possibly Iraq.[69] As many as seven Iranian cruise missiles were reportedly launched at the Khurais oil fields in September 2019.[70] As of this writing, little definitive information has been openly shared on the strike, including the exact type of cruise missiles used in the attack, although both Soumar and Quds-1 have been mentioned.[71]

Even though it was reported that three of the seven cruise missiles did not reach their targets for unknown reasons, Iran demonstrated the ability to seemingly successfully use its cruise missiles to target and strike a defended foreign target.[72] Beyond this attack, Iranian military exercises use cruise missiles not only for the purposes of developing and testing the readiness and capabilities of these systems, but also for the purpose of deterrence and signaling to the United States and others in the region.

A February 2019 naval exercise, named Velayat-97, in the Persian Gulf included the firing of SLCMs from surface ships.[73] Of particular note is that Iran successfully launched for the first time a cruise missile from a mini-submarine as well.[74] Iran also claimed that this SLCM successfully hits its predetermined target.[75] Also in February 2019, Iran announced the successful test of the Hoveizeh cruise missile, claiming the LACM, launched from a mobile launcher, struck a target at 1,200 kilometers.[76]

Another example is in January 2018, when Iranian naval forces reportedly tested its Ghadir cruise missile in the Gulf of Oman.[77] It is unclear whether this missile was fired from a surface ship or a coastal defense battery as this missile can be launched from either.[78] Particularly noteworthy, Iran used a life-sized mock-up of the aircraft carrier USS *Nimitz* as a target during "Great Prophet" war games in the Persian Gulf near the Strait of Hormuz in February 2015.[79] The attack on the simulated carrier included a variety of cruise missiles, including ASCMs, CDCMs, and at least one ALCM launched from a helicopter.[80]

It is also interesting to note that Iran has introduced a significant number of new cruise missiles recently, which indicates its interest in the weapon system. What is also significant is that these new missiles are being unveiled during difficult economic times due to ongoing punitive international economic sanctions and the high cost of military adventurism overseas in Syria and Yemen.

With no international bans on cruise missile development and testing as exist with ballistic missiles and considering Iran's success in the recent Saudi attack, it can be expected that Tehran will continue to work to develop its cruise missile capabilities as an important element of its defense and national security strategy. In addition, according to the Department of Defense, missile proliferation by Iran is also an issue:

> Iran has made extensive use of smuggling networks, managed both by its security forces and proxies, to provide advanced missile delivery systems to its clients.... Iran's emerging missile proliferation network poses a growing threat to U.S. forces, allies, and partners in the Middle East and beyond.[81]

Indeed, according to former U.S. Ambassador to the United Nations Nikki Haley, "Aid from Iran's Revolutionary Guard to dangerous militias and terror groups is increasing. Its ballistic missiles and advanced weapons are turning up in warzones across the region. It's hard to find a conflict or a terrorist group in the Middle East that does not have Iran's fingerprints all over it."[82]

One of those recipients are the Houthi rebels in Yemen.

Yemen

The war between the Saudi-led government and the Iranian proxy and ally, the Houthi rebels, has seen significant missile action since the war began in 2015. Indeed, the Houthis reportedly have launched over 100 missiles, including some cruise missiles, at Saudi Arabia from Yemen.[83]

For instance, in June 2019, the Houthi rebels in Yemen claimed responsibility for firing a cruise missile at a Saudi civilian airport 125 miles north of the Yemen–Saudi Arabia border, injuring some 20 people.[84] The Saudis claimed that the cruise missile used in the attack was an Iranian Ya Ali, while the Houthis claim it was a Quds-1, a cruise missile with seeming ties to Iran.[85] Also beyond Houthi cruise missile attacks on Saudi Arabia, the Director of National Intelligence (DNI) also noted another significant Houthi strike: "[a]n attempted 3 December [2017] cruise missile attack on an unfinished nuclear reactor in Abu Dhabi, UAE [United Arab Emirates]."[86]

The Director of the Defense Intelligence Agency noted in 2018:

> Iran has helped the Houthis improve their military and missile capabilities, demonstrated through Houthi missile launches against targets in Saudi Arabia and Saudi-led coalition ships in the Red Sea. We expect Tehran will refocus on stabilizing its allies and look for new opportunities to challenge its regional adversaries, such as Israel and Saudi Arabia.[87]

The DNI also reported in 2018 to Congress: "In Yemen, Iran's support to the Houthis further escalates the conflict and poses a serious threat to U.S. partners and interests in the region."[88] Beyond its own research, development, and testing, the Houthis' combat use of Iranian-sourced cruise missiles will potentially provide an important operational and technical feedback loop that will, as a result, possibly permit Iran to improve the capabilities and lethality of its cruise missile programs.

Lebanon

Iran's ally and proxy, the Lebanese terrorist group, Hezbollah, has also made use of Iranian-supplied cruise missiles. In 2006, during the Second Lebanon War, Hezbollah successfully identified, located, and struck the Israeli warship, INS *Hanit*, with an Iranian C-802, possibly Noor, anti-ship cruise missile.[89]

The attack, which was launched from the Lebanese coast, killed several sailors and crippled the Israeli ship. The Israelis seemed to be unaware that Hezbollah had such an advanced missile capability.[90] While not destroying the ship, the attack was a major propaganda victory for Hezbollah in the conflict with Israel. It is seemingly unknown in open-source literature, but should be expected, that Hezbollah maintains some level of Iranian-based anti-ship or land-attack cruise missile capability.

MAP 1

Iranian Cruise Missile Threat

Iranian cruise missiles are found across the Middle East, including near U.S. military forces and bases. U.S. Army bases in Iraq and Kuwait, plus a Navy base in Bahrain, Air Force bases in Qatar and the UAE, Naval forces in the Persian Gulf and eastern Mediterranean, and U.S. forces deployed to Syria and Saudi Arabia are all at risk.

SOURCE: Heritage Foundation research.

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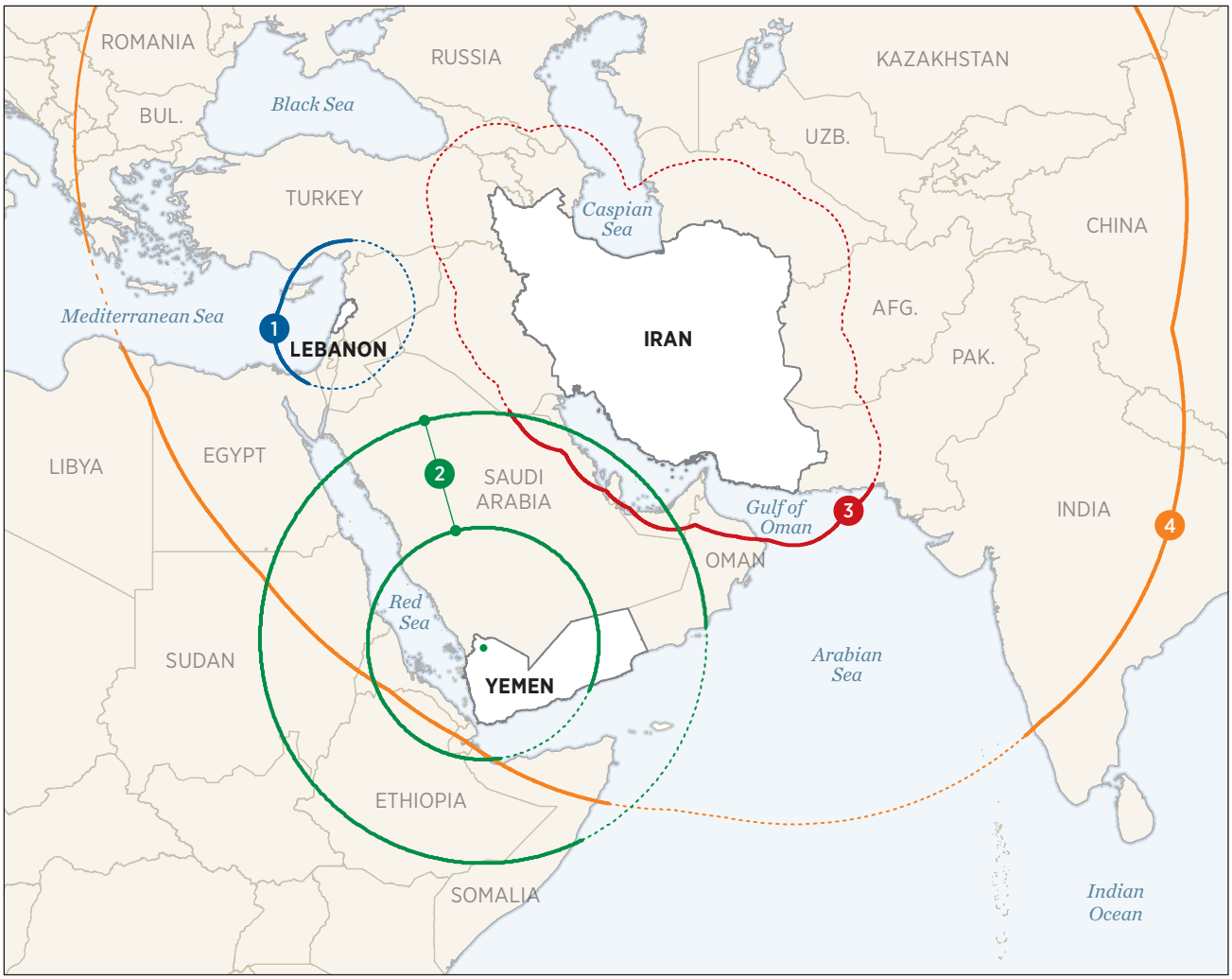
Of interest, though heavily involved in the Syrian civil war on the side of the regime of Syrian President Bashar Assad, Iranian cruise missiles have not seemingly been used in the conflict in Syria as of this writing.

Iran's Nuclear Program. Beyond concerns about Iran's and its proxies' use of cruise missiles with conventional warheads, there should also be concerns about the ability of these missiles to carry WMD. Considering Iran's troubling history with nuclear weapons research and development, which was active through 2003 and may be so today, worries about nuclear weapons should not be limited to just ballistic missiles.

MAP 2

Estimated Ranges of Iranian and Proxy Cruise Missiles



1 Lebanon—300 km range
In 2006, Iranian ally and terrorist group Hezbollah struck an Israeli warship with an Iranian anti-ship cruise missile.

2 Houthi-controlled Yemen—700–1,350 km range
The Quds-1 missile, associated with Houthi rebels and having ties to Iran, is estimated to have a possible range of between 700 and 1,350 kilometers.

3 Iran—300 km range
The Ghadir, a coastal defense cruise missile, gives Iran the ability to strike the Persian Gulf and Gulf of Oman.

4 Iran—2,000 km range
Iran's Soumar land-attack cruise missile has a reported range of 2,000 kilometers. This missile has the potential to strike targets across the Middle East, South Asia, and into Eastern/Southern Europe.

NOTE: Epicenter of Houthi-controlled area in Yemen is approximate.
SOURCE: Heritage Foundation research.

For instance, the State Department noted in August 2019 to Congress that regarding Iran's nuclear program, "[n]ew developments during the reporting period raise serious questions with respect to whether Iran intends to resume nuclear weapon related activities at some point in the future."[91] These concerns are based on the discovery of a large, secret repository of Iranian documents related to Iran's past nuclear weapons program, revealed by the Israelis.[92] It is even more disturbing when taken in concert with Iran's efforts to deceive International Atomic Energy Agency officials about possible military dimensions of its past nuclear activities.[93]

The State Department reported to Congress on the Amad Program, Iran's nuclear weapons program:

> Iran's efforts to retain records from its past nuclear weapons program, as well as Iran's steps to keep former weapons program scientists employed (e.g., at the SPND organization) on weaponization-relevant dual-use technical activities—and under the continued leadership of the former head of that program, Moshen Fakrizadeh—also suggest that Iran preserved this information to aid in any future nuclear weapons development work in the event that a decision were made to resume such work.[94]

In addition to this, concerns about Iran's atomic ambitions continue with its recent decision to violate several elements of the Joint Comprehensive Plan of Action (JCPOA), also known as the Iran nuclear deal. These include caps on low enriched uranium stockpiles, enrichment levels, and advanced centrifuge work.[95]

U.S. Counter-Cruise Missile Capabilities

While the United States has been cognizant of the evolving Iranian ballistic missile threat for some time, even deploying a missile defense system in Europe (known as the European Phased Adaptive Approach) to defend against Iranian ballistic missile threats, American forces and interests in the Middle East and into Southeastern Europe clearly face an expanded Iranian missile threat that now includes cruise missiles. U.S. warships, military bases, troops, and diplomatic facilities in the Middle East could all be the targets of Iranian or others' cruise missiles.

The cruise missile threat to U.S. interests from Iran and others is not likely to decrease considering current tensions in the Middle East and the recent success of Iranian and Houthi cruise missile attacks in Saudi Arabia. Fortunately, U.S. forces have several kinetic—or hard kill—systems that can

counter and destroy threatening cruise missiles, including a number of air and missile defense systems.

For instance, a cruise missile can be destroyed using an air-to-air missile, such as a Sidewinder or the Advanced Medium-Range Air-to-Air Missile, from a fighter aircraft such as the F-35 Lightning.[96] Naval weapons systems, such as the U.S. Navy's shipborne Aegis air defense system equipped with the SM-2, SM-6, Evolved Sea Sparrow Missile (ESSM), and the Close-In Weapon System, are capable of defending and defeating cruise missiles.[97]

The Army's Patriot Advanced Capability-3 and the National Advanced Surface-to-Air Missile System missile defense systems can also engage cruise missiles.[98] The Israeli Iron Dome system is also being considered.[99] Additionally, the Army is developing the multi-interceptor Indirect Fire Protection Capability (IFPC) for cruise missile defense.[100] The Navy and Air Force are looking at cruise missile defenses as well.[101]

There are certainly preventive and preemptive military options earlier in the kill chain to degrade, disrupt, or destroy cruise missile capabilities and capacities. These include air and missile strikes on the various platforms that launch missiles, missile stockpiles, and command, control, and communications facilities. In terms of non-kinetic—or soft kill—options, the U.S. Army is developing lasers for countering cruise missiles, among other threats, as part of its Maneuver Short-Range Air Defense and IFPC programs.[102]

In the end, U.S. forces are capable of killing cruise missiles. The challenge, of course, for cruise missile defense is threat detection. Due to their numerous stealthy advantages, it is important to be able to detect, identify, and track threatening cruise missiles as early as possible in the warning and engagement sequence. To augment land-based and sea-based sensors that may be limited by the laws of physics, airborne and space-based sensors can help provide 360-degree monitoring, detection, and tracking of cruise missiles across a wider area, enhancing the capability of air and missile defenses.

Another challenge is defending against the possibility of a significant number of cruise missiles being launched simultaneously, which, due to their unique advantages, might overwhelm defenses.

The United States has largely focused its air and missile defense on the manned aircraft and ballistic missile threat—and rightly so. As a result, the concern is whether the U.S. forces have a sufficient number of cruise missile defense systems in the Middle East area of responsibility to deal with the emerging Iranian cruise missile threat.

Operational Risks and Threats

Iran is clearly committed to the development of its missile arsenal as an instrument of statecraft and military power, helping to increase Iran's geopolitical influence. As an asymmetric threat to its possible opponents, it has the potential to relatively shift the military balance of power in the region.

The Iranian cruise missile arsenal and the proliferation of Iranian cruise missiles and its variants to its allies and proxies threaten American interests in the Middle East, including a large number of U.S. forces in the region, U.S. allies, and partners. Cruise missiles enhance Iran's air power and power projection. Iranian cruise missiles also could serve to increase instability, which could lead to broader regional conflict in a part of the world already fraught with insecurity.

As well, Iran's cruise missiles also threaten freedom of navigation and commercial and military shipping through important Middle Eastern waterways, such as the Persian Gulf, Strait of Hormuz, and Gulf of Oman. Hezbollah's and the Houthi's possession of cruise missiles extends the threat to the Mediterranean Sea, Arabian Sea, Gulf of Aden, the Red Sea, and Bab el-Mandeb Strait. Moreover, Persian Gulf oil supplies are threatened, including ports, oil and gas export terminals, pipelines, and production facilities. Another attack on Persian Gulf oil and natural gas suppliers would have an untold, but potentially significant, effect on global energy supplies and markets.

Tehran's proliferation of cruise missiles to the terrorist group Hezbollah and the Houthi rebels in Yemen vastly increases the threat posed by these non-state actors and their ability to project power and influence. In their possession, Iranian cruise missiles certainly could be employed in acts of terror involving a range of conventional and unconventional weapons, such as WMD.

Beyond the Houthis and Hezbollah, Iran could certainly transfer cruise missiles and technology to its ally, Syria, and or even to North Korea, a country with which it has had a ballistic missile relationship.[103]

Recommendations

In response to the growing Iranian cruise missile threat, the Trump Administration should:

Ensure a Positive Military Balance Against Iran in the Middle East. The United States and its allies should continue to maintain a favorable

military balance of power against Iran, its allies, and proxies to oppose Iran's malign activities in the region and deter the use of Iranian military forces, including cruise missiles, against U.S. forces and interests.

Cruise missiles are only one way that Iran could strike U.S. forces in the region, but the use of any weapon system is first and foremost a political decision made by Iranian leaders. These decisions can possibly be shaped through robust political and military deterrence and signaling before a hostile act is undertaken. Iran must understand that it will be held accountable for the use of force by itself, its allies, or its proxies against U.S. interests.

Continue the Maximum Pressure Campaign Against Iran. The Administration's maximum pressure campaign on Iran over its malign activities has been successful—and should be continued until Iran renegotiates a new agreement that addresses Iran's troubling international behavior.

An especially important element of the Administration's policy has been its ability to severely restrict the flow of funds into Iran's government coffers. This restriction reportedly has decreased Iranian defense spending, which surged after the 2015 nuclear deal.[104] Limiting Iran's government income means that Tehran has less funding for belligerent actions, such as supporting the war in Syria and Yemen, and defense spending, including its various missile programs.

In addition, any new agreement with Iran that may serve to augment or replace the JCPOA or move toward renewed diplomatic engagement or a normalization of relations should specify restrictions on the development of not just Iranian ballistic missiles, but Iranian cruise missiles, which can carry WMD as well.

Continue and Intensify Work with Key Middle Eastern Allies and Partners to Blunt the Iranian Cruise Missile Threat. The United States and Israel have successfully worked together on missile defense research and development for some time. Washington and Jerusalem should continue their fruitful work on missile defenses, including the Iron Dome air defense system, to enhance both countries' security.

In addition, the United States should encourage Gulf Cooperation Council (GCC) states to evaluate their air defenses in concert with the Pentagon. The United States should look favorably on and encourage the acquisition of threat-appropriate U.S. air and missile defense systems. Moreover, in concert with the United States, the GCC should also work to develop a networked and layered missile defense system across the Middle East that includes cruise missile detection and defense.

While potentially challenging, the sharing of threat information and steps toward integrating air defenses among GCC members will not only improve their defenses against cruise missiles but possibly reduce the destabilizing political, economic, humanitarian, and security effects of these weapons and others.

Replace United Nations Security Council Resolution 2231 with a New UNSCR. UNSCR 2231, which endorses the Joint Comprehensive Plan of Action, was unanimously adopted on October 18, 2015. Beyond Iran's nuclear program, the resolution has other related provisions in it that should be incorporated into a new UNSCR as soon as possible or, at a minimum, before the provisions expire. Doing so would take critical steps to hinder the development and expansion of Iran's cruise missile programs and the threat it represents to international security.

For example, there should be deep concern about the expiration of the existing general prohibition in UNSCR 2231 on the transfer of conventional arms to Iran without the approval of the Security Council, including missiles or missile systems. This arms sale ban expires in October 2020—less than one year from now.[105]

Ending this prohibition on arms transfers would allow the likes of Russia and China—both highly capable military, including cruise missile, powers—to transfer weapons, technology, and technical assistance to Iran that could markedly improve Iran's cruise missile arsenal.

In addition, in October 2023, Iran will no longer be restricted under UNSCR 2231 from activities related to ballistic missiles that are capable of delivering nuclear weapons.[106] At this point, not only would Iran be able to freely test its ballistic missile arsenal without condemnation or repercussion, Iran would be able to do the same for cruise missiles that are capable of delivering nuclear weapons. The new resolution should include a ban on both ballistic *and* cruise missiles.

While it is possible that Russia—or China—might veto a U.S. proposal on these issues in the U.N. Security Council despite the threat that Iran poses to international security, another permanent U.N. Security Council (UNSC) member, such as the United Kingdom or France, could introduce a new measure on arms sales and ballistic and cruise missile activities.

Absent success adopting a new U.N. resolution in the UNSC, Washington could—along with like-minded states—impose new or additional secondary sanctions on entities and states that sell arms to Iran or involve themselves with Iran's missile programs.

In addition, Congress should:

Hold Open- and Closed-Door Hearings on the U.S. Military's Ability to Defend Against the Growing Iranian Cruise Missile Threat in the Middle East. The U.S. military has many defense commitments in the current security environment, stretching from East Asia to Europe to the Middle East. Some of these U.S. operating theaters have existing or evolving cruise missile threats that must be defended against, especially Russia and China.

Congress should investigate, through hearings and congressional member and staff delegations, whether U.S. cruise missile defenses are adequate to the evolving threat environment in the Middle East.

This oversight process should also encompass a comprehensive understanding of the attack on Saudi oil facilities and an appreciation of the state of cruise missile defenses among U.S. allies and partners in the Middle East.

Provide Adequate Funds for U.S. Forces to Procure and Field the Necessary Number of Cruise Missile Defense Systems in the Most Expeditious Manner Possible. The United States has a number of different air and missile defense systems for cruise missiles. Congress should not only ensure that all important options, including soft-kill options, are investigated, but also exercise rigorous oversight of this process to ensure the most efficient and effective use of taxpayer dollars in delivering the necessary cruise missile defense systems to U.S. forces.

Arguably equally important is that Congress drive the U.S. national security establishment to work to improve cruise missile detection sensors, especially satellite systems that can provide real-time, 360-degree surveillance capabilities to national decision makers and the operating forces.

Conclusion

Iran's arsenal of LACMs and land-based and sea-based ASCMs enhance Iran's military might, power projection, and geopolitical influence. In a period of rising tensions with Iran, alongside significant ongoing instability in the Middle East, Iranian cruise missiles pose a growing threat to U.S. interests in the region, especially deployed U.S. military forces.

The proliferation of Iranian cruise missiles to Tehran's allies and proxies is also a challenge to American interests in the Middle East, including those of U.S. allies and partners. In the possession of non-state actors, Iranian cruise missiles increase the range of the conventional and unconventional

threats these groups pose—including the possibility of terrorist acts. As such, the growing threat of Iranian cruise missiles and their proliferation merit the immediate attention and action of the Trump Administration and Congress to protect American forces and advance U.S. interests in the Middle East.

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Endnotes

1. Yun Li, "Saudi Oil Production Cut By 50 Percent After Drones Attack Crude Facilities," September 14, 2019, CNBC, https://www.cnbc.com/2019/09/14/saudi-arabia-is-shutting-down-half-of-its-oil-production-after-drone-attack-wsj-says.html (accessed October 23, 2019).
2. Ibid.
3. Kenneth P. Werrell, *The Evolution of the Cruise Missile* (Maxwell Air Force Base: Air University Press, 1985), https://pdfs.semanticscholar.org/946a/82dd1d86767fa38f5a6ba7e478ee75a6d563.pdf?_ga=2.119990476.51844685.1573635147-417291732.1573635147 (accessed October 8, 2019).
4. U.S. Department of Defense, *DOD Dictionary of Military and Associated Terms*, October 2019, https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/dictionary.pdf (accessed June 7, 2019).
5. Defense Intelligence Ballistic Missile Analysis Committee, "Ballistic and Cruise Missile Threat 2017," June 2017, https://www.nasic.af.mil/Portals/19/images/Fact%20Sheet%20Images/2017%20Ballistic%20and%20Cruise%20Missile%20Threat_Final_small.pdf?ver=2017-07-21-083234-343 (accessed October 8, 2019).
6. Ibid.
7. Ibid.
8. U.S. Defense Intelligence Agency, *Iran Military Power 2019*, U.S. Government Printing Office, https://www.dia.mil/Portals/27/Documents/News/Military%20Power%20Publications/Iran_Military_Power_V13b_LR.pdf (accessed November 19, 2019).
9. U.S. Department of Defense, "Summary of the 2018 National Defense Strategy of the United States of America," https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf (accessed November 19, 2019).
10. Office of the Secretary of Defense, *Missile Defense Review 2019*, https://media.defense.gov/2019/Jan/17/2002080666/-1/-1/1/2019-MISSILE-DEFENSE-REVIEW.PDF (accessed June 3, 2019).
11. Ibid.
12. Defense Intelligence Agency, "Statement of the Record: Worldwide Threat Assessment," March 6, 2018, https://www.dia.mil/News/Speeches-and-Testimonies/Article-View/Article/1457815/statement-for-the-record-worldwide-threat-assessment/ (accessed June 4, 2019).
13. U.S. Department of Defense, *Missile Defense Review 2019*.
14. Defense Intelligence Agency, "Statement of the Record: Worldwide Threat Assessment."
15. Ibid.
16. Missile Defense Advocacy Alliance, "Soumar," http://missiledefenseadvocacy.org/missile-threat-and-proliferation/todays-missile-threat/iran/soumar-cruise-missile/ (accessed October 23, 2019).
17. Defense Intelligence Ballistic Missile Analysis Committee, "Ballistic and Cruise Missile Threat 2017."
18. Ibid.
19. Ibid.
20. Missile Defense Advocacy Alliance, "Soumar."
21. Defense Intelligence Ballistic Missile Analysis Committee, "Ballistic and Cruise Missile Threat 2017," and Missile Defense Advocacy Alliance, "Meshkat," https://missiledefenseadvocacy.org/missile-threat-and-proliferation/todays-missile-threat/iran/meshkat/ (accessed October 10, 2019).
22. Rory Jones and Sune Engel Rasmussen, "What We Know About the Saudi Oil Attacks," *The Wall Street Journal*, September 20, 2019, https://www.wsj.com/articles/what-we-know-about-the-saudi-oil-attacks-11568991017 (accessed October 10, 2019).
23. Missile Defense Advocacy Alliance, "Soumar," and Missile Defense Advocacy Alliance, "AS-15 Kent (Kh-55 Granat)," https://missiledefenseadvocacy.org/missile-threat-and-proliferation/missile-proliferation/russia/as-15-kent-kh-55-granat/ (accessed October 23, 2019).
24. Missile Defense Advocacy Alliance, "Soumar."
25. Behnam Ben Taleblu, "Iranian Cruise Missiles Also a Proliferation Threat," Real Clear Defense, February 23, 2018, https://www.realcleardefense.com/articles/2018/02/23/iranian_cruise_missiles_also_a_proliferation_threat_113100.html (accessed June 4, 2018).
26. Office of the Secretary of Defense, *Missile Defense Review 2019*.
27. Defense Intelligence Ballistic Missile Analysis Committee, "Ballistic and Cruise Missile Threat 2017."
28. "Iran Unveils Long-Range Cruise Missile on Revolution Anniversary," Reuters, February 2, 2019, https://www.reuters.com/article/us-iran-revolution-anniversary-missiles/iran-unveils-long-range-cruise-missile-on-revolution-anniversary-idUSKCN1PR054 (accessed October 8, 2019).
29. Ibid.
30. Jeremy Chin, "Iran Displays Hoveizeh and Qased 3 Cruise Missiles," Center for Strategic and International Studies Missile Defense Project, February 5, 2019, April 8, 2019, https://missilethreat.csis.org/iran-displays-hoveizeh-and-qased-3-cruise-missiles/ (accessed September 20, 2019).

31. Michael Peck, "Iran Says Its Cruise Missiles Are Better Than America's," The National Interest, September 9, 2019, https://nationalinterest.org/blog/buzz/iran-says-its-cruise-missiles-are-better-america%E2%80%99s-78681 (accessed September 20, 2019).
32. Ibid.
33. Shahryar Pasandideh, "Under the Radar, Iran's Cruise Missile Capabilities Advance," War on the Rocks, September 25, 2019, https://warontherocks.com/2019/09/under-the-radar-irans-cruise-missile-capabilities-advance/ (accessed October 8, 2019).
34. Fabian Hinz, "Abha Airport Missile Attack: Understanding the Houthi-Iranian Logic in Escalation," Foreign Policy Research Institute, June 17, 2019, https://www.fpri.org/article/2019/06/abha-airport-missile-attack-understanding-the-houthi-iranian-logic-in-escalation/ (accessed October 8, 2019).
35. U.N. Security Council, "Resolution 2216," S/RES/2216, April 14, 2015, http://unscr.com/en/resolutions/doc/2216 (accessed November 13, 2019), and U.N. Security Council, "Resolution 2456," S/RES/2456, February 26, 2019, http://unscr.com/en/resolutions/doc/2456 (accessed November 13, 2019).
36. Ibid., and Jon Gambrell, "Analysts: Weapons in Saudi Attack Similar to Iranian Ones," Associated Press, September 18, 2019, https://www.apnews.com/22d6918dfc874d5eb838be138e3c47e9 (accessed October 8, 2019).
37. Jeremy Binnie, "Yemeni Rebels Unveil Cruise Missile, Long-Range UAVs," *Jane's Defense Weekly*, July 8, 2019, https://www.janes.com/article/89746/yemeni-rebels-unveil-cruise-missile-long-range-uavs (accessed October 4, 2019).
38. Gambrell, "Analysts: Weapons in Saudi Attack Similar to Iranian Ones," and Jones and Rasmussen, "What We Know About the Saudi Oil Attacks."
39. John Miller, "Iran's New Threat to Ships in the Gulf," International Institute for Strategic Studies, March 6, 2019, https://www.iiss.org/blogs/analysis/2019/03/iran-new-anti-ship-missile-test (accessed October 10, 2019).
40. Office of Naval Intelligence, "Iranian Naval Forces: A Tale of Two Navies," February 2017, https://www.oni.navy.mil/Portals/12/Intel%20agencies/iran/Iran%20022217SP.pdf (accessed October 9, 2019).
41. Ibid.
42. "Iran Launches Cruise Missile from Submarine for First Time During War Drills," *South China Morning Post*, February 24, 2019, https://www.scmp.com/news/world/middle-east/article/2187473/iran-launches-cruise-missile-submarine-first-time-during-war (accessed September 20, 2019).
43. Ibid.
44. Ibid.
45. Nasser Karimi, "Tehran: Iran Launches Cruise Missile from Sub During Drill," Associated Press, February 24, 2019, https://www.militarytimes.com/flashpoints/2019/02/24/iran-launches-cruise-missile-from-submarine-during-drill/ (accessed October 8, 2019), and Kyle Mizokami, "Iran Shows off Unusual Ship-Killing Torpedo/Missile Combination," *Popular Mechanics*, February 28, 2019, https://www.popularmechanics.com/military/navy-ships/a26574258/iran-torpedo-missile-combination-jask-2/ (accessed October 8, 2019).
46. Karimi, "Tehran: Iran Launches Cruise Missile from Sub During Drill,"
47. Office of Naval Intelligence, "Iranian Naval Forces: A Tale of Two Navies."
48. "Iran's Navy Test-Fires 'Noor' Anti-Ship Cruise Missile," Tasmin News Agency, January 29, 2016, https://www.tasnimnews.com/en/news/2016/01/29/984611/iran-s-navy-test-fires-noor-anti-ship-cruise-missile/photo/11 (accessed October 8, 2019).
49. Office of Naval Intelligence, "Iranian Naval Forces: A Tale of Two Navies."
50. Ibid.
51. Ibid.
52. Ibid.
53. Ibid.
54. Ibid.
55. U.S. Defense Intelligence Agency, *Iran Military Power 2019*.
56. Ibid.
57. "Iran Unveils New 'Cruise Missile' In Military Exhibit," Radio Farda, January 31, 2019, https://en.radiofarda.com/a/iran-unveiled-new-cruise-missile-in-military-exhibit/29743646.html (accessed October 22, 2019).
58. Office of Naval Intelligence, "Iranian Naval Forces: A Tale of Two Navies."
59. "Iranian Cruise Missile to Be Delivered to IRGC: Deputy Defense Minister," Tasnim News Agency, January 13, 2019, https://www.tasnimnews.com/en/news/2019/01/13/1921734/iranian-cruise-missile-to-be-delivered-to-irgc-deputy-defense-minister (accessed October 9, 2019).
60. The White House, "Statement from the President on the Designation of the Islamic Revolutionary Guard Corps as a Foreign Terrorist Organization," April 8, 2019, https://www.whitehouse.gov/briefings-statements/statement-president-designation-islamic-revolutionary-guard-corps-foreign-terrorist-organization/ (accessed October 9, 2019).
61. Nasser Karimi and Jon Gambrell, "Iran's Supreme Leader Limits Range for Ballistic Missiles Produced Locally," Associated Press, October 31, 2019,

https://www.defensenews.com/global/mideast-africa/2017/10/31/irans-supreme-leader-limits-range-for-ballistic-missiles-produced-locally/ (accessed October 22, 2019).

62. "Shahid Hemat Industrial Group (SHID)," Iran Watch, https://www.iranwatch.org/iranian-entities/shahid-hemat-industrial-group-shig (accessed November 13, 2019).
63. Ibid.
64. Office of Naval Intelligence, "Iranian Naval Forces: A Tale of Two Navies."
65. U.S. Department of State, "Adherence and Compliance with Arms Control, Nonproliferation, and Disarmament Agreements and Commitments," August 2019, https://www.state.gov/wp-content/uploads/2019/08/Compliance-Report-2019-August-19-Unclassified-Final.pdf (accessed November 13, 2019).
66. Jack Detsch, "Suspected Iranian Strikes Raise U.S. Concerns Over Chinese Missile Proliferation," AL-Monitor, September 17, 2019, https://www.al-monitor.com/pulse/originals/2019/09/us-concern-china-missile-technology-iran.html#ixzz60eo7oJy8 (accessed September 26, 2019).
67. Loren Blinde, "DIA Director Stewart Highlights Worldwide Threats," Intelligence Community News, May 24, 2017, https://intelligencecommunitynews.com/dia-director-stewart-highlights-worldwide-threats/ (accessed June 4, 2019).
68. Peter Brookes, "The Growing Iranian Unmanned Combat Aerial Vehicle Threat Needs U.S. Action," Heritage Foundation *Backgrounder* No. 3437, September 17, 2019, https://www.heritage.org/defense/report/the-growing-iranian-unmanned-combat-aerial-vehicle-threat-needs-us-action.
69. Stephen Kalin, "Media Visit Saudi Oil Plant Damaged in Strike Blamed on Iran," Reuters, September 19, 2019, https://www.reuters.com/article/us-saudi-aramco/media-visit-saudi-oil-plant-damaged-in-strike-blamed-on-iran-idUSKBN1W40VN (accessed October 23, 2019); Sune Engel Rasmussen and Isabel Coles, "Iran-Backed Kataib Hezbollah Has Long Targeted U.S. Forces, *The Wall Street Journal,* December 29, 2109, https://www.wsj.com/articles/iran-backed-kataib-hezbollah-has-long-targeted-u-s-forces-11577661868 (accessed December 30, 2019); and Humeyra Pamuk, "Exclusive: U.S. Probe of Saudi Oil Attack Shows It Came from North – Report," Reuters, December 19, 2019, https://www.reuters.com/article/us-saudi-aramco-attacks-iran-exclusive/exclusive-u-s-probe-of-saudi-oil-attack-shows-it-came-from-north-report-idUSKBN1YN299 (accessed December 30, 2019).
70. "Saudis Say Weapons Debris Proves Iran Behind Oil Attack, U.S. Denounces 'Act Of War,'" Radio Free Europe/Radio Liberty, September 18, 2019, https://www.rferl.org/a/saudi-arabia-says-drones-missiles-used-in-oil-attack-sponsored-by-iran-/30171635.html (accessed October 23, 2019).
71. Shawn Snow, "Drone and Missile Attacks Against Saudi Arabia Underscore Need for More Robust Air Defenses," September 26, 2019, *Military Times*, https://www.militarytimes.com/flashpoints/2019/10/25/drone-and-missile-attacks-against-saudi-arabia-underscore-need-for-more-robust-air-defenses/ (accessed October 28, 2019).
72. "Saudis Say Weapons Debris Proves Iran Behind Oil Attack, U.S. Denounces 'Act of War.'"
73. "Iran Fires Cruise Missiles in Ongoing Naval Drills," *Xinhua*, February 23, 2019, http://www.xinhuanet.com/english/2019-02/23/c_137844941.htm (accessed October 10, 2019).
74. Karimi, "Tehran: Iran Launches Cruise Missile from Sub During Drill."
75. Ibid.
76. "Iran Launches New Cruise Missile on Revolution Anniversary," *South China Morning Post*, February 3, 2019, https://www.scmp.com/news/world/middle-east/article/2184845/iran-launches-new-cruise-missile-revolution-anniversary (accessed October 10, 2019).
77. Ahmad Majidyar, "Iran Tests New Cruise Missile During Naval Drills," January 23, 2018, Middle East Institute, https://www.mei.edu/publications/iran-tests-new-cruise-missile-during-naval-drills (accessed October 10, 2019).
78. Ibid.
79. Brad Lendon, "Iran Blasts Mock U.S. Carrier in War Games," CNN, February 27, 2015, https://www.cnn.com/2015/02/26/world/iran-mock-carrier-destroyed/index.html (accessed October 17, 2019).
80. Ibid., and Jassem Al Salami, "Iran Staged a Savage Mock Attack on a U.S. Aircraft Carrier Back in 2015," The National Interest, August 16, 2019, https://nationalinterest.org/blog/buzz/iran-staged-savage-mock-attack-us-aircraft-carrier-back-2015-74196 (accessed October 22, 2019).
81. U.S. Department of Defense, *Missile Defense Review 2019*.
82. Ibid.
83. Ibid.
84. Sudarsan Raghavan, "Houthi Missile Strike Hits Saudi Airport, Injuring 26," *The Washington Post*, June 12, 2019, https://www.washingtonpost.com/world/houthi-missile-strike-hits-saudi-airport-injuring-26/2019/06/12/55cb5032-8d0c-11e9-b162-8f6f41ec3c04_story.html?utm_term=.1a71f223bcb3 (accessed June 12, 2019).
85. Binnie, "Yemeni Rebels Unveil Cruise Missile, Long-Range UAVs."
86. Daniel R. Coates, "Statement for the Record: Worldwide Threat Assessment of the U.S. Intelligence Community," Office of the Director of National Intelligence, February 13, 2018, https://www.dni.gov/files/documents/Newsroom/Testimonies/2018-ATA---Unclassified-SSCI.pdf (accessed

June 4, 2019).

87. Defense Intelligence Agency, "Statement of the Record: Worldwide Threat Assessment."
88. Ibid.
89. Yaakov Katz, "Intel. Flaw to Blame in INS Hanit Attack," *The Jerusalem Post*, October 16, 2006, https://www.jpost.com/Israel/Intel-flaw-to-blame-in-INS-Hanit-attack (accessed October 7, 2019), and J. E. Dyer, "Hezbollah's Maritime Threat," *Commentary*, March 26, 2010, https://www.commentarymagazine.com/foreign-policy/middle-east/hezbollah%e2%80%99s-maritime-threat/ (accessed October 7, 2019).
90. Katz, "Intel. Flaw to Blame in INS Hanit Attack."
91. U.S. State Department, "Adherence to and Compliance with Arms Control, Nonproliferation, and Disarmament Agreements and Commitments."
92. Ibid.
93. Ibid.
94. SPND, according to the State Department, is Iran's Defense Research and Innovation Organization, an organization subordinate to the Iranian Ministry of Defense and Armed Forces Logistics. See ibid.
95. David Albright and Andrea Stricker, "IAEA Iran Safeguards Report Analysis: Nuclear Deal Violations Persist, Cooperation Decreasing," Institute for Science and International Security, September 2, 2019, http://isis-online.org/isis-reports/detail/iaea-iran-safeguards-report-analysis-nuclear-deal-violations-persist-cooper (accessed October 7, 2019).
96. U.S. Department of Defense, *Missile Defense Review 2019*.
97. Ibid.
98. Ibid., and Raytheon, "National Advanced Surface-to-Air Missile System (NASAMS)," https://www.raytheon.com/capabilities/products/nasams (accessed October 23, 2019).
99. Jen Judson, "It's Official: U.S. Army Inks Iron Dome Deal," *Defense News*, August 12, 2019, https://www.defensenews.com/digital-show-dailies/smd/2019/08/12/its-official-us-army-inks-iron-dome-deal/ (accessed October 23, 2019).
100. U.S. Department of Defense, *Missile Defense Review 2019*.
101. Sydney J. Freedberg, "Lasers To Kill Cruise Missiles Sought By Navy, Air Force, Army," Breaking Defense, October 29, 2019, https://breakingdefense.com/2019/10/lasers-to-kill-cruise-missiles-sought-by-navy-air-force-army/ (accessed November 5, 2019).
102. Sydney J. Freedman, "New Army Laser Could Kill Cruise Missiles," Breaking Defense, August 5, 2019, https://breakingdefense.com/2019/08/newest-army-laser-could-kill-cruise-missiles/ (accessed October 22, 2019).
103. Michael R. Gordon, "Iran Poses Challenge to U.S. With New Ballistic-Missile Test," *The Wall Street Journal*, July 26, 2019, https://www.wsj.com/articles/iran-poses-challenge-to-u-s-with-new-ballistic-missile-test-11564179487 (accessed October 11, 2019).
104. "Tehran's Military Expenditures Decline; Iran-Made Missiles, Drones, To Make Up For Ban On Imports," Radio Farda, June 12, 2019, https://en.radiofarda.com/a/29995011.html (accessed October 22, 2019).
105. United Nations Security Council, "Resolution 2231," S/RES/2231, July 20, 2015, http://unscr.com/en/resolutions/doc/2231 (accessed October 11, 2019).
106. Ibid.