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Dynamics of Iran's missile program and its implications on the region

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Abstract: Iran's ballistic arsenal is one of the largest in the Middle East, and, according to the Director of National Intelligence, many of Iran's missiles are "inherently capable of carrying a nuclear payload" (Hildreth, 2012). Iran has made important technical strides in recent years with regard to missile development: it has successfully placed three satellites into low earth orbit using its own two-stage launch vehicles. It has built and successfully tested multi-stage missiles with improved long-range guidance, diversified fuel capabilities, and accuracy. These developments allow Iran to extend the range of its missiles and to deploy and fire them more quickly within a short time span. Iran has also worked to ensure the survivability of its missiles, mobile launching capabilities, and deployment to newly built silos. The objective of this study is to understand the dynamics of Iran's missile program, particularly in the scenario of its implication on the Middle East. Qualitative and analytical techniques have been utilized to produce effective reading for the research scholars and academicians.

Keywords: Iran; GCC States; Russia; North Korea; Nuclear arms; MTCR; Ballistic missile defense system

1. Introduction

The tension between Iran and its powerful neighbors goes a long way toward explaining why Iran feels the need for greater defense capabilities. Iran was forced to consider nuclear and ballistic options because of the long and bloody war with Iraq, which had a profound role in shaping Iran's strategic thinking (Rezaei 2016). Iran had little in terms of conventional equipment to deter Iraq from launching missile attacks. Thus, the leaders concluded that Iran would need a powerful deterrence of some kind. At its core was the belief that Iran's existence in an unstable and dangerous environment was precarious and that it had suffered horribly during and after the war.

But the embargo on weapon sales pushed by the United States proved to be a huge obstacle for obtaining a strong deterrence. The strained relations with the United States made it even difficult for Iran to access technologies needed to maintain its air force capabilities. Obtaining standard weapons and ammunition in the black market involved extremely complex arrangements. Things got much worse when, at the request of Iraq, the United States launched Operation Staunch, a global ban on the sale of weapons to Iran in 1983 (Mistry 2007). Because of the weapons embargo, North Korea was the only country willing to do business with Iran, selling it short-range Scud missiles. Ayatollah Ali Akbar Hashemi Rafsanjani, the then Speaker of the Majlis, parleyed key role in initial contacts into broader cooperation; by the mid-1980s Pyongyang aided in creating an indigenous missile industry in exchange for shipments of oil (Rafsanjani 1982).

The weapons embargo led the regime to believe that, ultimately, Iran must rely on its own resources for self-defense. In his memoir, Hassan Rouhani revealed that the leadership took a unanimous decision to achieve security self-sufficiency, which led the Revolutionary Guards to create the "self-sufficiency unit" in 1986. The official task was to develop military industries that would require no assistance from other countries. Headed by Hassan Tehrani Moghaddam, the "founding father" of the Iran missile program, the unit was essentially a Research and Development (R&D) Institute for missile technology. To complement the R&D effort, in 1986, the Guards launched an industrial venture, the Shahid Hemmat Industrial Group (SHIG), located in Malard near Tehran. Brigadier General Mohamad Husein Jalali and Brigadier General Hussein Mantequei were put in charge of the production in SHIG. At first, Moghaddam was forced to reverse-engineer the Soviet-era Scud technology, designing the Shahab-1 from a Scud-B missile, which was rolled out by SHIG. But Moghaddam had a more ambitious plan to develop medium and long-range missiles to deter possible attacks from Israel and other perceived enemies of the regime. In early 1997 the SHIG unveiled a prototype of Shahab-3 C with a range of 2,000 km, Iranian's Medium-Range Ballistic Missile (MRBM).

Based on the original Scud-C technology, it was a supped-up version of the North Korean Nodong 1. Intelligence reports disclosed that Russians and

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Chinese technicians helped with engineering the Shahab-3; the latter was said to help with the targeting and control systems. After a series of initial failures in-flight tests, the Shahab 3 was officially added to the ballistic fleet in July 2003. Following further modifications, the missile was introduced as Ghadar 110, also known as Ghadar 101 (Chipman 2010). Dissatisfied with the Nodong's reliability and precision, Iran sought Russian assistance in obtaining high-grade alloys to improve the strength of the missile while maintaining its lightweight. Iran also obtained special metal foils to protect the missile's navigation system, a wind tunnel and other equipment to test the missile, technology to enable the warhead to withstand high speeds, and technology to create asymmetrical warheads that are more capable of evading antimissile defense systems ("Iran Missile Program," 2017). Energomash, a Russian missile engine manufacturer, provided Iran with equipment to improve the Shahab-3 engine.

All along, the Iranians were working hard to achieve the stated goal of "self-sufficiency." During 1994, intelligence report revealed that 350 Iranian scientists re studying flight theory at the Khrunichev State Research and Production Space Center in Moscow. U.S. intelligence sources named the Russian firm Polyus, which specialized in missile guidance systems, as assisting the Iran missile programs. These efforts seemed to have paid off, as by 1998 Ali Shamkhani, told the Kayhan newspaper that Iran reached self-sufficiency in missile production and would be able to operate without outside assistance (Wehling 1999). To increase its deterrence posture, Iran was known to rename missile programs, exaggerate their performance, and declare untested technologies as operations. Following important breakthroughs in solid fuel technology and multistage missile assembly under the consolidated leadership of the Missile Corps, Iran went on to produce a variety of new missiles. Shahab-3 modification, Ghadr 110, and its variants, Emad, Shahab-4, Shahab-5 (Kosar), Shahab-6 (Toqyān), and Sejjil followed down the line. Reportedly, these missiles could carry all kinds of warhead.

The Sanam Industries Group, also known as the Parchin Missile Industrial Group, located on the sprawling Parchin base, had a role in the new push. Sanam engineers were reported to develop the solid fuels line. The group's name first surfaced in 1993 when its collaboration with the Russian Central Aerodynamic Institute (TsAGI) was announced. On October 28, 1997, it was announced that Iran had developed the Shahab-4 with a range of 2,000 to 4,000 km, capable of carrying a 1,200-kg payload and successfully tested in May and June 2002 in the Semnan region. Western intelligence suggested that the missile was designed to use a variant of the RD-216 liquid-propellant rocket motor originally developed for the Russian SS-5 Skean missile (Patrick 1997, P10). Russia was reported to be the primary contractor of the Shahab-4, whereas China denied any involvement in developing Iran's missile program ("Lauds Iran for Self-Sufficiency in Arms Industry," 1998).

On June 16, 1998, Iran purchased telemetry equipment19 for missile testing from China's Great Wall Industries for its Shahab missile programs. On September 29, 1998, authorities announced that Iran was developing the Shahab-5 ballistic missiles, also known as Kosar. Not yet operational, the Shahab-5 is the two-stage version of the North Korean Taep'o-dong-2 expected to have a range of 4,000-4,300 km with a 1,000 kg nuclear payload" (Konstantin 1998). On November 3, 1998 Rajab Safarov, member of the political consultation committee for the Russian President and vice president of the coordination center for the Russian-Iranian program described the Shahab-5 as an ICBM with a range of up to 10,000 km, which can carry chemical, biological, or nuclear warheads. Reportedly, China cooperated with Russia to complete the Shahab-5 missile. In December 1998, an Israeli intelligence report claimed that Iran is developing a new ballistic missile called Shahab-6 as an ICBM with the help of China, North Korea and Russian aerospace technicians and state-run entities. On October 16, 2002, the National Council of Resistance of Iran (NCRI), an opposition group, announced the existence of Iran's Shahab-6. The sources also claim that it has a range of 3,000-5,000 km with a 750-500-kg warhead.

Variations of the Shahab-3, including the Ghadr-1, have a range of almost 2,000 km with a higher maneuverability than the Shahab-3. Ghadr-1 – a liquid-fueled medium range ballistic missile with approximately 1,950 km range – began flight tests in 2004, a version with a dramatically modified nose and, as with other Shahab-3 designs, capable of carrying all kinds of warhead (Ehsan, n.d.). Sejjil-1, a solid-fueled, two-stage ballistic missile with an estimated range of over 2,000 km, and its more advanced version, Sejjil-2, were important addition to the arsenal. The latter would give Iran greater flexibility in hitting targets such as Israel. It is capable of carrying a payload of 500 to 1,000 kg of warheads (Ehsan, n.d.). Because of its solid propellant, the missile needs less time and fewer support vehicles for launching as opposed to liquid-fuel missiles. Rapid relocation of the launcher vehicle makes it hard to destroy the system on the ground. Uzi Rubin, the former director of Israel's Ballistic Missile Defense Organization noted that the Sejjil had a truly original design bearing no resemblance to foreign missiles. Rubin added that the Sejjil put Iran on the path of developing an intercontinental ballistic missile (ICBM).

Another missile known as, Ghadr project was started and it is an improved version of Shahab-3 another Iranian long-range ballistic missile capable of carrying a nuclear warhead, specifically designed to evade missile defenses (Ehsan, n.d.). According to military experts, the specific design and alterations to this finned Reentry Vehicle (RV) give it greater stability, increased maneuverability, and a high degree of accuracy. Another Iranian ballistic missile

known as Fajr-3 is a multiple independently targeted reentry vehicle (MIRV) that reportedly can carry several warheads, and evade most sensitive radar systems as well as anti-missile systems. Unveiled during the Holy Prophet war-games on March 31, 2006 the missile successfully tested and is believed to be a medium-range ballistic missile with an estimated range of 2,000 km ("Iran's on the Table Options Against Tel Aviv and America," 2008).

In addition to a successful ballistic missile program, Iran has also placed several satellites into orbit using its own two-stage launch vehicles. Iran has also built and tested multi-stage ballistic missiles, and successfully improved their guidance along with improving and diversifying the fuel used to propel its ballistic missiles. Iran's rapid and successful development in missile expertise has led to increased concern of the United States and its allies about the country's intentions. Israeli intelligence analysts held that "Iran could be building a fleet of long-range missiles that, armed with conventional warheads, might serve a 'saturation' strategy". As Rubin put it, "a salvo of such conventionally-armed missiles against an Israeli city, for example, could substitute for Iran's skeletal air force. Since many of Iran's ballistic missiles can carry a nuclear warhead, the country may also develop a long-range nuclear weapon delivery system."

2. Research methodology

Keeping in view of the nature of the study, both qualitative and analytical technicques has been adopted. Ample literature on the topic is available both in forms of publish and online resources. An effort has been made to acquire the relevant information from all available resources. Books, monographs, newspapers and accredited journals including online authentic resources has been utilized to produce a quality paper for the readers. Paper based on sociological bases or Qualitative Methods in Social Research (Esterberg 2002) examine effectiveness of information systematically and empirically through careful data collection and thoughtful analysis (Patton 1990). The same technique has been applied to provide an assessment of related regional and international response.

3. Literature review

Taremi (2005) argues that during the Iran-Iraq War, the imperative to deter Iraqi attacks on Iranian civilian centers and the need to develop a means of delivery for nuclear weapons were the primary factors that drove Iran to acquire a ballistic missile capability. In the postwar years, Iran's ballistic missile program has been primarily driven by the need to prevent a US invasion through impeding the USA's ability to project force into the region and threatening to target oil facilities in the Persian Gulf. These requirements have compelled Iran's ballistic missile industries to concentrate on greater range, improved accuracy, and the development of solid-fuelled engines and more advanced warheads.

Chubin, (2010) highlighted that Iran's nuclear program looms ever larger among international threats. Were Iran to acquire a nuclear weapon, it could menace Israel, whose existence Iran does not recognize, blackmail smaller neighboring states, and possibly deter the United States from fulfilling security guarantees to regional states or projecting power throughout the Persian Gulf. A nuclear Iran could be emboldened to foment political unrest throughout the Middle East, especially in countries with large Shiite minorities. Elleman (2010) said that the Islamic Republic's arsenal now includes several types of short-range and medium range missiles. Estimates vary on specifics, and Iran has exaggerated its capabilities in the past. But there is widespread consensus that Tehran has acquired and creatively adapted foreign technology to continuously increase the quality and quantity of its arsenal. It has also launched an ambitious space program that works on some of the same technology.

Ismail (2015) argues that as a result of its geostrategic, geopolitical, and ecocultural position, Iran has a special influence on regional politics. Iran's nuclear program can tilt the balance of power in West Asia in its own favor, but the competing states from the region are expected to oppose such a program. Iran's choice of nonconventional weapons would be extremely likely to influence neighboring countries to start their own nuclear weapons programs to maintain the balance of power in the West Asian region. This article contends that the Iranian nuclear issue should be dealt with immediately. It concludes that the issue of Iran's nuclear ambitions must be properly resolved because it can lead to a new round of regional and global nuclear proliferation.

According to Izewicz (2017) during EU Non-proliferation Consortium, Iran's ballistic missile programme has long been a source of tension in Iran's immediate neighbourhood and beyond. Providing Iran with a diverse and extensive arsenal, the ballistic missile programme plays multiple roles: it is an important element of military doctrine, a means of deterrence, and a tool of statecraft. Continued implementation of the nuclear agreement is inextricably linked to Iran's ballistic missile programme, ensuring that, at least for its duration, Iran does not develop a nuclear warhead to mount on top of a missile. Controlling Iran's access to sensitive goods will also remain important, but Iran's progress to date has demonstrated the limits to what export controls alone can achieve. As a result, other approaches, though rife with difficulty, merit some exploration. Bahgat (2019) said that the significant weakening of Iran's air force, in combination with Saddam Hussein's intense use of missiles against Iranian military targets and civilian population, were the major drivers of the nation's missile program. Foreign Minister Mohammad Javad Zarif stated, "If there is an art we have perfected in Iran, and we can

teach it to others for a price, it is the art of evading sanctions".

4. Regional and international responses

4.1. US-Israel response

In response to the failure to stop Iran's ballistic missile programme, Iran's regional neighbors, the USA and NATO have also focused on missile defense capabilities. Facing a range of rocket and missile threats, Israel's missile defense system has three major components: Iron Dome (protecting against short-range threats), David's Sling (focused on long-range rockets and slower-flying cruise missiles fired at ranges between 40 km and 300 km) and Arrow (the system's top tier) (Sharp 2015). Its most recent subsystem, Arrow -3, is specifically designed with an eye towards threats emanating from Iran. The project has been jointly developed by Israel and the USA, with the US Government contributing $450 million between fiscal years 2008 and 2015 (Arie 2015). It was delivered to the Israeli Air Force in January 2017. Under the new 10-year security assistance Memorandum of Understanding, Israel is slated to receive an unprecedented $5 billion from the USA towards missile defense assistance, disbursed in $500 million annual installments between fiscal years 2019 to 2028 (Ronen, 2015).

To increase combat preparedness, the United States and Israel hold the biannual joint exercise codenamed Juniper Cobra, a five-day combined military exercise against regional threats, including missile attacks. Under a 10-year deal signed in 2007 (for the FY2009 to FY2018), Israel has received $3 billion annually in direct foreign assistance from the United States, approximately one-fifth of the U.S. foreign aid budget. The only stipulation attached is that over 70 percent of this sum has to be spent on U.S. military hardware. The 2015 report by the Congressional Research Service entitled "U.S. Foreign Aid to Israel," indicates that the White House gave 3.1 billion dollars to Israel in direct bilateral military aid for the Fiscal Year 2015. The Obama administration, granted 619.8 million dollars for the joint U.S.-Israel missile defense programs designed to protect Israel from potential threats from its enemies. Moreover, as part of a "compensation package" for the JCOPA, Israel demanded a squadron of advanced F-15 Strike Eagles and V-22 Osprey tilt-rotors planes, reportedly worth more than 3.1 billion dollars. It was reported that the Israelis asked for Boeing's F-15SE Silent Eagle derivative equipped with Radar Cross Section (RCS) reduction features and internal weapons bays housed inside the jet's conformal fuel tanks (Arie 2015).

In present escalation of military tensions between US and Iran, after the death of top Iranian, Islamic Revolutionary Guards Corps (IRGC), Maj. General Qasim Soleimani, Iran launched its missile attack on US bases in Iraq, Ain-al-Asad and Erbil. In a statement on Twitter, Iranian Foreign Minister Mohammad Javad Zarif said Iran had taken and concluded "proportionate measures in self-defence" under Article 51 of the UN Charter. "We do not seek escalation or war, but will defend ourselves against any aggression," he said. IRGC officials were quoted in state media warning the US against retaliating for the missile strikes. They said Israel could be attacked if it did (The Guardian 2020). Earlier, it was reported that because of the precautions, no one was killed or seriously injured, but the missiles heavily damaged living areas and left huge craters (Arraf 2020). However, a US military official told CNN that 11 service members had been injured in the attack, which was first reported by Defense One. Following the attack, the Pentagon had initially said that no casualties had resulted from the 16 missiles fired by Iran. The US military defines a casualty as either an injury or fatality involving personnel (Tapper et.al 2020). Yet, while the U.S. has defense systems capable of protecting the bases at Ain al-Asad and Erbil, the bases remained vulnerable because the U.S. lacks sufficient ballistic missile defense intercept capacity (Bowman et.al 2020). However, in crises and military conflicts, an adversary's intentions can change quickly; it is therefore at least as important to focus on enemy capabilities (Bowman 2020).

4.2. The gulf cooperation council allies response

One report indicates that between October 2010 to 2014, Saudi Arabia ordered 90,435 billion dollars' worth of weapons in a major new arm transfer from the United States alone including some of the most modern weapons in the U.S. inventory. The SIPRI recently announced that Saudi Arabia alone spent 85.3 billion dollars in 2015, to advance its military ammunition, compared to Iran's 10 billion dollars (Arie, 2015). Best underscoring Saudi Arabia's willingness to win the arms race in the region was Riyadh's decision to spend 30 billion dollars on advanced jets and helicopters in 2011. Saudi Arabia ordered four larger surface warships and six smaller corvette-class ships at the same time. The deal also involved a 1.9 billion dollars contract for an unrevealed amount of MH-60R Sikorsky helicopters in addition to some smaller ships and aircraft which are part of an upgrade to Saudi's Fleet in the Persian Gulf. Even after the JCPOA was announced, Saudi Arabia signed up to buy 600 Patriot missiles from the U.S. at 5 billion dollars, and it is expected to purchase 10 more Sikorsky MH-60R naval helicopters (Sadjadpur 2008, p4).

Qatar has signed a contract worth 17 billion dollars with France for Rafale fighter jets, and plans to purchase Boeing F-15s. Kuwait, another GCC member recently struck a deal with Boeing worth 3 billion dollars, purchasing Boeing 28 F-18 Super Hornets, a rapid response, dependable tactical fighter jet with twin-engine carrier-based multirole with capability of carrying air-to-air missiles and air-to-surface weapons. In 2013, the UAE signed a contract worth 200 million dollars with General Atomics Predator drones delivered in April 2016. According to SIPRI, the combined expenditure of

UAE and Saudi Arabia is six times higher than that of Iran (Karami 2016).

In addition to cutting-edge military wares, the Gulf countries enjoy access to superior American training, Intelligence, Surveillance, and Reconnaissance (ISR) systems as well as its Command, Control, Communications, Computer, and battle management capabilities (C4I/BM) (Rezai 2015). Because of U.S. C4I/BM, the Gulf countries face virtually no technological risks when choosing combat systems.

Saudi Ballistic Defense System (BDS) has been supplemented by the Terminal High Altitude Area Defense, (THAAD) a Lockheed made interceptor, powered by the Raytheon AN/TPT-2 E-Band radar. THAAD has a flawless performance record against a variety of short and medium-range missiles. Some military experts have suggested the United States link the Saudi BDS to that of the Gulf States, Jordan, and Israel into a single and effective response command ("The Hague Code of Conduct," n.d.).

In the Gulf region, the USA deploys Patriot batteries in Bahrain, Kuwait, Qatar and the United Arab Emirates (UAE) in order to protect high-value targets such as airfields, port facilities and military bases. Kuwait and Saudi Arabia currently operate Patriot PAC -2 batteries of their own, which they are looking to upgrade, while Qatar intends to procure PAC-3 batteries (Erästö 2018). The UAE already deploys PAC-3 and was the first country to deploy the Terminal High Altitude Area Defense (THAAD) system outside of the USA. Qatar, Saudi Arabia and possibly Oman have also expressed interest in the system. Moreover, US ships equipped with the Aegis system could provide an additional layer of defense if they were moved into the Gulf; THAAD, too, can be deployed into the region within weeks (Erästö, 2018).

Although all the relevant capabilities are in place, the lack of integration between them poses a significant challenge. This stems primarily from mistrust between members of the Gulf Cooperation Council (GCC) and their varying threat perceptions and priorities. Despite efforts, progress has been stilted and any meaningful cooperation in this area will probably take years to materialize.

5. Conclusion

The study shows that Iran-Iraq war was a long and destructive which derived Iranian leadership to initiate missile program. The Iraqi authorities used its missile supremacy during the war and destroyed many key Iranian installations and cities. Soon after the war an armed race initiated and as an important regional player Iran took all necessary steps to upgrade its defensive and offensive abilities against its rivals. The clerical elite view Iran's asymmetric military assets as the most vital dimension of Tehran's national security policy, and place great importance on indigenous weapons production. Due to international sanctions imposed by United States and its allies Iran looked towards eastern powers to fulfill its needs to upgrade its defense industry. Initially, Iran obtained support from North Korea but soon it successfully gained technology from China and Russia. Bilateral and multilateral understanding between these countries played an important role in success of Iranian Missile program. Furthermore, a number of Iranian scientists also got training from Russia and MOU between private organizations were also signed. Iran developed its major ballistic missile systems in last two decades and according to reports it has ballistic missiles capable to hit short and long rang targets. Iran has steadily ramped up its investment in cruise missile technologies.

One core component of Iran's asymmetric military strategy has been the procurement, production and deployment of coastal defense cruise missiles. In the event of any conflict with the United States, Iran would likely use HY-2 cruise missiles to attack American warships in the Persian Gulf and to close the Strait of Hormuz. The Iranian authorities claim that the missile technology will be used only for deterrence and peaceful purposes but due to its involvement in regional conflicts and un-friendly relations with regional states, most of the international community doesn't accept Iranian claims. Especially Israel and GCC states believes that Iranian Missile program is a security threat for them and in this regard, they not only highlighted the issue in United Nations but also seek support form United States for obtaining and development of Ballistic Missile Defense system as well. All these countries are spending a great amount of capital to upgrade their military capabilities. Although, United States lifted sanctions related to Iran's nuclear program after the implementation of the Joint Comprehensive Plan of Action (JCPOA) in January 2016, sanctions relating to Iran's ballistic missile program remain in place. Additional sanctions have been imposed in response to Iran's 2016 and 2017 missile tests. The recent US administration under the presidency of Donald Trump further tightened the security protocols and sanctioned against Iran which further escalated the tensions in region. The situation is beneficial only for arms manufacturers and militarily advanced countries. Therefore, it is important for the regional states that they must resolve all regional conflicts through negotiations and mediation of UN and it is the only way which can bring stability in region otherwise the ongoing proxy war will continue and it will eventually sabotages the future of the region.

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