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# IRANIAN DRONES- MILITARY LESSONS FOR INDIA

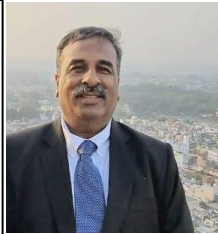
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# CENTRE FOR JOINT WARFARE STUDIES



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### IRANIAN DRONES-MILITARY LESSONS FOR INDIA



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### Abstract

Iran's drone programme had roots in the 1980s war of attrition with Iraq when it started developing Unmanned Aerial Vehicles (UAVs) as part of its Strategy and Defense doctrine. The Revolutionary Guard took the lead in incorporating drones into its forces.<sup>1,2</sup> Iran used these versatile platforms for missions, including Intelligence, Surveillance, Reconnaissance (ISR), and air-to-ground strikes, by mounting simple rocket launchers under its wings. Though rocket launcher drones did not perform well operationally during the war, loitering munitions gained traction.<sup>3</sup> Russia has deployed the Shahed loitering munitions and Mohajer combat drones<sup>4</sup> imported from Iran in significant numbers and used across Ukraine, with devastating results. The development of unmanned underwater surface vehicles has added a new dimension to the threats posed to the sea lanes. These threats, with their small size, make it difficult to detect visually or with RADARs and SONARs. Today, the Iranian military has an impressive arsenal of various types of drones, notably by reverse engineering, which are cheap and mass-produced.

### Introduction

When the revolutionaries came to power in Iran in 1979, they took pride in rejecting the established world order. The first supreme leader of the nation, Ayatollah Ruhollah Khomeini, vowed that his state would be "either East nor West," resulting in Iran being

under an arms embargo since 1979. Iran has suffered from military disadvantages because many countries have restricted dual-use exports to Iran, affecting its ability to acquire the necessary equipment. Iran has not been an incubator for new technology but has quickly adopted it. Iran adopted telegraphy soon after Europe and the US in 1935 and established a nuclear program early in 1957. Mohammed Reza Shah, who ruled Iran from 1941 until his 1979 ouster, ensured that Iran possessed a state-of-the-art Air Force. The Islamic Revolution, which led to various military sanctions, devastated Iran as it could no longer purchase modern platforms. The 1980–88 Iran-Iraq War where Iran's revolutionary regime was caught unprepared by the surprise Iraqi invasion. As a result, during and after the Iran-Iraq War, the Iranian authorities initiated the growth of the indigenous military industry to avoid relying on anyone for asymmetric technologies. Despite a military budget typically ranging from \$15-\$20 billion annually, Iran fields more armed drones than many countries, which spend two or three times more on defence<sup>5</sup>. Much of the manufacturing of Iranian drones remains indigenous.

In 1988, the US Navy devastated Iran's air force and Navy in a skirmish, resulting in the largest surface naval engagement since World War II. In its aftermath, Iranian strategists understood they could not hope to confront the United States directly by sea. Drones, however, were relatively inexpensive and had broad utility. The Iranian investment took off.<sup>6</sup> Following the war with Iraq, Tehran sought to enhance its drones' surveillance and reconnaissance capabilities, severely limiting their flight range to the line of sight. Later, the Iranian industry focussed on two primary roles: surveillance and attack. In the past, they could only attach cameras or bombs to crude drones, limited by the weather and their controllers' line of sight. Iranian UAV platforms, over a period, have witnessed growth for both purposes and have developed significantly. Almost all branches of the Iranian military now regularly use drones for their specific needs.

This paper attempts to study the trajectory of the growth of Iranian drones and its implications for India.

### **Challenges**

On January 19, 1984, the US Department of State formally designated Iran a state sponsor of terrorism, leading to a ban on defense exports and controls over exports of dual-use items. In 1995, US President Bill Clinton used executive orders to augment sanctions on Iran, prohibiting trade and transshipments<sup>7</sup> of critical goods to Iran. In 1995, US President Bill Clinton used executive orders to boost sanctions. The 1996 Iran-Libya Sanctions Act further empowered the US government to act against private companies in Iran.<sup>8</sup> Hence, Iranian engineers had to develop the drones indigenously. The technology that could not produce it acquired it by leveraging businessmen in the diaspora and other friendly countries, as it was easier to smuggle smaller electronic components for the drones, which are generally dual-use components too. On April 19, 2023, the United States imposed sanctions on a procurement network supporting Iran's drone and military programs, targeting companies and suppliers in China.<sup>9</sup> The U.S. Department of the Treasury's Office of Foreign Assets Control (OFAC) on Sept 19,

2023, sanctioned seven individuals and four entities based in Iran, the People's Republic of China (PRC), Russia, and Türkiye in connection with Iran's unmanned aerial vehicle (UAV) and military aircraft development.<sup>10</sup> This network has facilitated shipments and financial transactions in support of the U.S.-designated Iran Aircraft Manufacturing Industrial Company's (HESA's) UAV.

### **Geo-Political Challenges**

Iran's geopolitical situation in the Middle East and its support to the Houthis militia that dominates Lebanon alarms Israel, Saudi Arabia, and UAE. The largest consumer of Iran's oil is China. In response to the trade of millions of barrels of oil each month in 2021, China and the Islamic Republic of Iran signed a 25-year agreement allowing the Chinese to penetrate nearly all sectors of Iran's economy. Iran receives weaponry and civil nuclear technology from Russia. Russian exports to Iran rose by 27 percent in 2022. Both China and Russia appear committed to utilising Iran to check American influence<sup>11</sup>. Iran exercises influence through proxy networks extending to Iraq, Syria, Lebanon, and Yemen through the special Revolutionary Guard unit, the Quds Force. On September 10, 2023, Israel's intelligence services, Mossad Director, revealed they and foreign partners had foiled 27 Iranian-orchestrated terrorist plots over the last year. Iran is facing sanctions on the supply of crude oil and has used drones for "balance of power competition," where it has been carrying out attacks on the oil supply chains of the US, Europe, and Saudi Arabia.<sup>12</sup>

Iran has maintained its peaceful nuclear program, but the IAEA's Director-General has warned Tehran has enough enriched uranium for "several" nuclear bombs if it chooses to build them.<sup>13</sup> IAEA access was initially refused by Tehran so that Iran might remove evidence. In its resolution on September 12, 2003, the IAEA demanded that Tehran make "a full declaration" following its safeguards agreement, which is the fundamental contract that signatories to the Nuclear Non-Proliferation Treaty signed with the IAEA<sup>14</sup>. Recently, the UN imposed an arms embargo on Iran as part of Resolution 2231, which included the Nuclear deal. Britain, Germany, France, and the United States told the International Atomic Energy Agency (IAEA) on September 14, 2023, that further action would be needed on Iran if the country did not fulfill legal obligations and clarify issues over nuclear material.<sup>15</sup>

### **Doctrinal Underpinnings**

Iran's conventional power is weak, and it has shown more proficiency in Grey Zone warfare, a core component of its strategic doctrine, which led to the growth of the drone's development. The Iranian military doctrine has two dimensions: ideological-political and military-technical. The ideological-political dimension encompasses a belief in the Islamic Republic's responsibility as the protector of Islam. The military-technical part guides the formation of military forces and tactics that achieve these political goals in addition to the traditional tasks of safeguarding territorial integrity and national independence. These doctrinal considerations have generated a unique, bifurcated military structure that boasts of a regular military, the *Artesh*, and an

irregular military/militia, the Islamic Revolutionary Guard Corps (IRGC). The 'Artesh' tri-service primarily defends Iran's borders from external threats. The IRGC aims to protect the Iranian revolution from foreign or domestic threats. The IRGC established the Ra'ad Reconnaissance Battalion in 1983 to operate UAVs. After the IRGC Aerospace Force (IRGC-AF) creation in 1985, the Ra'ad Battalion was transferred to the Aerospace Force and renamed the UAV Unit. The Unit operates Iran's most advanced drones, like the Shahed and the Saegheh. The IRGC Navy has established drone bases in the east, west, and at 'Jask' north of the Strait of Hormuz on the Arabian Sea; Iran conducts constant flights into the Arabian Sea and north of the Persian Gulf.

**Development of Drones.** Iranians began a three-pronged development approach. The first was naval, where a confrontation with the US Navy in 1988 was the most significant surface naval skirmish after World War II. It highlighted the need to equip the Iranian Navy and Islamic Revolutionary Guard Corps with modern ships. The second was the development of ballistic missiles to augment the deficiencies in air power owing to the grounding of F-14 Tomcats and AH-1 Super Cobra helicopters, for which the supplies of spares were not forthcoming due to the embargo after the 1979 revolution. The Joint Comprehensive Plan of Action (JCPOA)<sup>16</sup> did not oblige Iran to end its ballistic missile programme and also heralded the growth of ballistic missiles. The third was the development of unmanned aerial vehicles, the least publicised Iranian asymmetric tools, which have progressed for the last 35 years. The Iranian drone programme comprising tactical, mid-range, and strategic drones is one of the oldest in the world and has become the centrepiece of military technology exhibits.

Regarding Civil-Military Integration, IRGC took the lead in developing drones with the requisite politico-military push. The drone programme progressed quickly, partly thanks to its research-based and continuing academic support from industrial institutions such as the Sharif University of Technology. The country has invested in technology and continues developing its programme using civil-military integration. In addition, Tehran has facilitated a vast network of suppliers, including China, Japan, and the European countries. Iran has also tried illegally acquiring technology related to engines from the West<sup>17</sup>. Even though the sanctions are impacting the economy, Tehran still invests its limited resources in creating offensive drone capabilities. The following manufacturing entities were involved in the development of drones:

- HESA established Qods Aeronautics subsidiary, an IRGC drone manufacturer, in 1984 to specialise in drone development. Later, Qods Aviation Industries and HESA, in 1989, were brought under the Ministry of Defence and Support of Armed Forces. The Shahed, manufactured by HESA, appears to be the mainstay workhorse of the IRGC's UAV fleet.
- Qods Aeronautics makes two types of drones, the Mohajer and Saeqeh; the Iran Aircraft Industrial Company produces the Ababil.
- The Islamic Revolutionary Manufacturing Guards Corps has assembled the Ayoub drone.



- The IRGC Aerospace Force also ran its extensive drone Research and Development (R&D) programme within its Shahed Aviation Industries, producing suicide drones like the Shahed 141 to the Shahed-191 flying wing drones cheaply.

**Fig 1: Iranian Drone**



Source: The Economic Times <sup>18</sup>

## Growth of Drones

Iran launched the armed drone called the Mohajer-1 in 1985 and began experimenting with the Ababil-1 as a short-range multirole drone in 1986. Iran developed it during the Iran-Iraq War and the prototype in 1985. While the Iranian forces used it mainly to take photographs of Iraqi strongholds, it was also Iran's first weaponised UAV armed with RPG-7 anti-tank rockets. The Ababil was upgraded in the 1990s after unveiling the surveillance and attack drone Karrar prototype in 2009. Later, Iran started developing drones like the H-11 Sarir, which could fire long-range missiles. Tehran has a history of capturing and reverse-engineering US drones. On Aug 22, 2023, Iran's Defence Ministry unveiled a drone resembling America's armed MQ-9 Reaper<sup>19</sup>. Currently, the status of current significant holdings is as follows:

**Table 1: Categories of Iranian Drones with Specification<sup>20</sup>**

Role	Name	Year	Range (km)	Speed kmph	Ceiling	Endurance
Combat	Sarir	2013	200	150	5000 m	5 hr
Combat	Saqeh	2016	50	250	3,350 m	45min
Surveillanc	Shahed-171	2019	4400	460	12000 m	10 hr

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Combat	Shahed-129	2012	2000	150	7300 m	24 hr
Combat	Fotros	2013	2000	250	7620 m	30 hr
Tactical	Nazir Harbinger	2011	50	210	4572 m	3.5 hr
Kamikaze	Raad-85	2010	96	250	4572 m	8 hr
Surveillance and Combat	Mohajer-10 UCAV	2023	2000	210	7315 m	24 hr
Suicide	Meraj-521	2022	5	180	150 m	15 min
Aerial Target	Ababil-2 <sup>21</sup> with LOS	1997	50	100	4270 m	15 min
Aerial Target	Ababil-2 with GPS	2001	150	100	3,350 m	15 min
Armed Drone	Karrar	2010	500	900	14300 m	15 min
ECM	Mohadjer-4 <sup>22</sup>	1990	150	322	4572 m	5-7 hr
Loitering	Shahed 136	2021	2500	185	4000 m	2 hr
ISR	Shahed-191	2019	450	90	12000 m	4 hr
Combat	Kaman22	2019	100	3000	7294 m	24 hr

**Source: Author's Own**

Fig 2: An Iranian Kaman-22 drone is carried on a truck during an annual military parade marking the Iran-Iraq War before the shrine of the late revolutionary founder Ayatollah Khomeini, just outside Tehran, Iran, September 22, 2023.



Source: AP Photo/Vahid Salemi

**Fig 3:** Iranian President Ebrahim Raisi, second right, attends a ceremony unveiling the Mohajer-10 drone on Aug. 22, 2023.



Source: Iranian Presidency Office, via AP

### **Proliferation**

- In 2023, in addition to acquiring drones directly from Iran, Moscow, with Tehran's help, is building a Geran factory in Russia, located in the Republic of Tatarstan.<sup>23</sup>
- In 2019, Houthi rebels from Yemen used drones to attack Saudi oil facilities.<sup>24</sup>
- As early as November 2004, reports of the Lebanese militia Hezbollah operating the so-called Mersad-1 drones (identical to the Ababil-2) and Karrar over northern Israel by Hezbollah<sup>25</sup>. Incidents of the downing of Hezbollah drones by IDF in July 2022, as reported in the media.<sup>26</sup>

### **Lessons for the Indian Military**

The lessons from the technological trajectory of the growth of Iranian Drones for the growth of Indian Ecosystem are as follows:

- **Indigenisation Takes Time.** Despite being decades old, the Iranian drone programme continues to have shortcomings, some of which are inherent in the technology, such as the trade-off between range and autonomy. The country's UAV industry initially faced several limitations, including failure to produce reliable turbojet engines, a lack of satellite-navigation-enabled targeting, control links to expand its drone arsenal, severe flight control system-related software flaws, and take-off and landing incidents<sup>27</sup>.



- **Reverse Engineering.** Iran has mastered the art of reverse engineering drones. The IRGC reverse-engineered technologies from the US Navy's RQ-170 Sentinel drone, which Iran downed in 2011, made the Saeqeh and the Shahed-191 drone<sup>28</sup>. HESA began reverse engineering the turbojet-powered MQM-107A Streaker practice target drones acquired from the U.S. in the 1970s. Combined with the South African Denel Skua target drone<sup>29</sup> technology, they produce the Karrar drone, which looks like a cruise missile with wider wings. Iran shot down a U.S. Navy RQ-4A Global Hawk drone in the Strait of Hormuz<sup>30</sup> in 2019. Unveiled in September 2013, the Iranian press claims the Yasir resulted from reverse engineering the Scan Eagle downed over Iran 10 months earlier. The Iranian media first mentioned the Sarir in April 2013, claiming it was a stealth UAV capable of surveillance via photo and video and equipped with air-to-air missiles. Iranian sources compare the Sarir to Israel's RQ-5 Hunter.
- **Resilient GPS/PNT/Navigation** In April 2016, Gen. Amir Ali Haji Zadeh, Commander of the IRGC Air Force, announced that Iran had upgraded drones to take advantage of satellite-based Global Positioning System (GPS) technology.<sup>31</sup> "Cyber-attacks" for GPS spoofing in military operations have been a source of worry. The Iranian-designed unmanned aerial vehicles use several types of navigation, rendering jamming or spoofing less effective. Iranian drones are relatively low-tech and guided by a civilian GPS, which can be jammed. Iran has done away with the satellite connections for some versions to counter the GPS jamming. Instead, its UAVs are usually controlled by line-of-sight radio controls or can self-guide using GPS systems like those seen in commercial sat-nav systems. The Shahed-136, launched in 2021, is a loitering munition designed to operate in a contested environment, using an inertial navigation system and GPS as a backup.
- **Drones as PGM.** Earlier, the Precision-Guided Munitions were not typically carried by Iranian UAVs. Instead, the drone served as the guided bomb, swooping down on its target before going up in flames like a robotic kamikaze. Now, Iran has the Saeqeh drones that carry PGMs. Also, the Shahed-133 can carry two Precision Guided Munitions (PGM) and take off vertically from tactical vehicles. India, too, is indigenising its capabilities. Ghatak under development, is an autonomous, stealthy UCAV armed with missiles and precision-guided munitions. It will be a flying-wing design with an internal weapons bay and a turbofan engine. The prototype is likely to be rolled out in 2024-25<sup>32</sup>.
- **Maritime Domain.** Iranian Navy had announced that the country's naval forces are using advanced drones equipped with sonar detection technology to target sub-surface vessels, including the capability to detect submarines<sup>33</sup>. At Def Expo 2020, the flagship event of the Ministry of Defence, Larsen, and Toubro

(L&T) displayed its newly developed underwater drones, Adamyra, Amogh, and Maya. Adamyra can be launched from surface ships and submarines and last for 8 hours at a depth of 500 meters.<sup>34</sup>

- **Counter Drone Capabilities.** Counter Drones Operations began in 2007. Iran reportedly took over a US drone successfully.<sup>35</sup> India's counter-drone capabilities, customised tackling of customised drones-UAVs, micro-drones, drones operating without Radio Frequency (RF) command and control links, and using automated target tracking<sup>36</sup> are critical. Drones, in all their forms, are also creating new security risks for airports, oil fields, and other vital infrastructure. In addition to the drones with military-grade electronic defence and encryption standards, many civilian or amateur drones are in use in the Russia-Ukraine conflict. Effective countermeasures are the need of the hour. Offensive activity to counter adversary drone operations requires high-end electronic attack systems. The current generation of Iranian drones flies so low that they can avoid detection by air defences. At the same time, their navigation systems are robust enough to make it hard to take them down with anti-drone electronic warfare weapons that disrupt radio frequencies<sup>37</sup>. Iran's capability to team the drones with reconnaissance and rapid-targeting systems has profoundly impacted the conflict in Ukraine. Pairing of surveillance and loitering munitions are destroying the antennas of the counter-drone systems of Russia, thereby rendering the systems dysfunctional. The industry should be able to provide solutions to meet the new threats quickly.
- **Civil-Military Fusion.** Broadly, four facets of civil-military Fusion have pivotal roles in the growth of the drone ecosystem. The first one is the need for Politico-Military Fusion, where the whole of government approach is needed for the ecosystem to prosper. Secondly, there must be a system to reach out to the industry where the information is shared widely using strategic communication, and the ecosystem then endeavours' the industry to provide an emerging technology. Thirdly, the industry will have to extend the Industrial Civil-Military Fusion by tailoring the dual-use technology to meet the military needs. Finally, an Economic and Financial Fusion by the angel investors and market forces to create a viable ecosystem to fund the start-ups and industry to develop niche technology in terms of scale and cost is the need of the hour. The Iranian drone industry has taken many years to mature. Though the Iranian Drone program started in 1979, the prototype flew only in 1985. Hence, the civil–military fusion needs to be encouraged so that the country can produce cheap and variety of drones to meet the specific tasks of the services.
- **Non-State Actors.** After the Nagorno-Karabakh war and the current Ukraine conflict, the loitering munition drones have become ubiquitous and may become accessible to non-state actors. This threat needs to be addressed.

## **Conclusion**

Until recently, air power was a tool wielded only by wealthy actors in combat and conflict; nation-led Armies have developed it. However, drones have become increasingly affordable and an established part of conventional warfare in recent years. Modern conflicts are dominated by many factors: unequal war, asymmetric confrontation, precision weapons, electronic warfare, camouflaged enemy dispersions, cyber and space involvement, the transition from operated systems to unmanned ones, etc., resulting in the concept of greater utilisation of airspace by sensors and weapon systems. Drones are an effective element of air power for tackling "high-value targets" at a favourable cost-benefit analysis.

Iran's conventional power is weak and has shown more proficiency in asymmetrical warfare, a core component of its strategic doctrine, which led to the growth of drone development. Iran's export of drones to Russia during the current conflict was mainly due to Moscow's need for a cheap, expendable unmanned system. Much of the manufacturing of Iranian drones remains indigenous using the civil-military fusion, though Iran has made efforts to acquire technology through indigenous and from other countries. Due to the country's isolation in world politics, it has used its R&D base, academia, and industrial base notably by reverse engineering. Today, the Iranian military has an impressive arsenal of various types of drones.

An important takeaway for India is that the critical infrastructure faces growing risks from drone terrorism. A network of remotely operated or autonomous counter-drone systems must be stationed at essential infrastructure sites to maintain control while allowing a more rapid response to drone events.

## **DISCLAIMER**

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