'War of the Cities'.

Iran - emerging space state or threat to world peace?

Henk H F Smid
Space analyst
& author, The
Netherlands

Iran recently celebrated 40 years of revolution and 10 years of spaceflight. In 2019, the Islamic Republic of Iran commemorated the 40th anniversary of the revolution that transformed the state into a theocracy - with a parliament but with the clergy ultimately in charge. It was also the year in which Iran celebrated the 10th anniversary of the launch of an indigenous satellite with its own resources. However, there is currently little to celebrate. As a result of international sanctions and consequent devastating inflation, Iran is on the verge of an economic abyss. Space analyst Henk Smid describes how Iranian spaceflight is entangled with international policy towards Iran's nuclear and armament aspirations.

Since the early 1970s, Iran has focused on developing a strong ballistic missile capacity and this has been an important part of the country's defence and deterrence strategy. The impetus came after the war with Iraq between 1980-1988 for which Iran was ill-prepared and during which Sadam Hussein aimed missiles at Iranian troops and cities, including Tehran, Tabriz, Isfahan and Shiraz. Only after Iran had acquired missiles from abroad could it retaliate effectively - which included attacking Baghdad. But the

▲ Nuclear reactor in Iran.

international community did little to stop this 'War of the Cities'.

A second reason for Iran's armaments strategy is the 40 years of bilateral and multilateral sanctions. As a result, Iran no longer has financial reserves to buy weapons abroad, such as modern military aircraft, and is restricted from doing so anyway. By contrast, Israel, Saudi Arabia and the United Arab Emirates are amply equipped with modern weapons, mainly purchased from the US, UK and France.

Thirdly, although ballistic missiles may be seen as a 'poor man's weapon', Iran has managed to create a large, domestically-produced arsenal of missiles that give the Iranian government a degree of respect.

Political background

Iran's space programme has developed from a perception that the country is being harassed by the West. The purchase or development of geostationary communications satellites was thwarted by the sanctions and even Russia eventually removed its support. Commercial space imaging, required for defence strategies and civilian tasks, was prohibited by the sanctions (at the same time as being made available to countries surrounding Iran). So, if Iran wanted to survive, it had to create its own space programme.

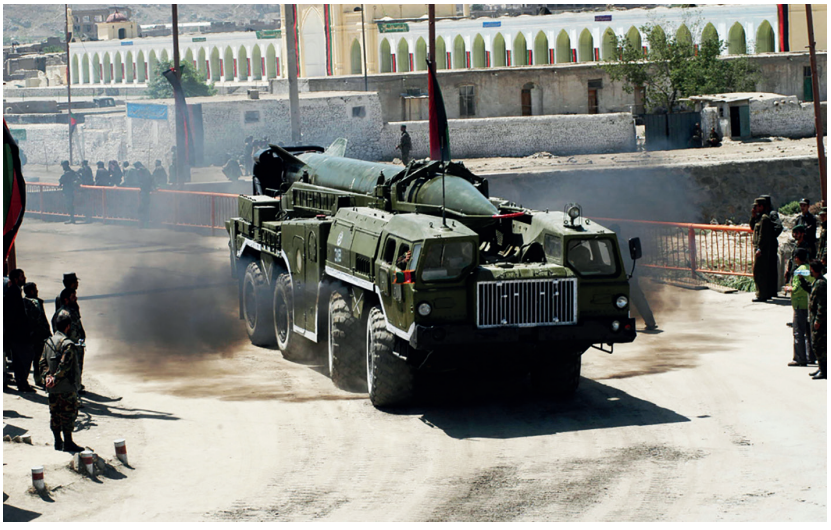
The necessary development of an Iranian satellite launch capability was immediately regarded by the West as a veiled offensive missile programme, whilst having its own observation satellites was considered detrimental to states in the Middle East that were kind-hearted to the West.

The Iranian leadership has pursued nuclear energy technology since 1950 and Iran's nuclear programme is inextricably linked to the development of missiles. It was partly encouraged by the Atoms for Peace programme of American President Eisenhower in 1957 and made steady progress with the help of the West for more than two decades. However, this aid ended after the Iranian revolution of 1979, mainly because the West was concerned about what else the Iranians could do with this technology.

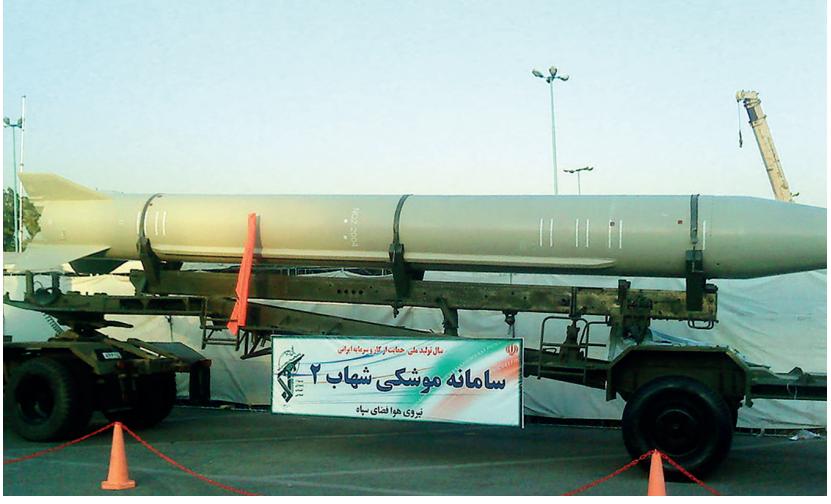
Iran revived its civilian nuclear programmes in the 1990s, but when it became known in 2002/03 that Iran was also involved in uranium enrichment research, the international community raised the alarm. While this could indicate the development of a nuclear weapon, Iran has always rejected allegations that it wants to develop an atomic bomb. In 2007, the US intelligence services stated that Iran had ended its nuclear weapons programme in 2003, but the White House (under President Bush) warned that Iran was still pursuing an atomic bomb. Distrust of Iran's nuclear ambitions was strengthened when it was announced, in 2009, that a second uranium enrichment plant had been built, in secret, near the holy city of Qom.

Iran's space programme has developed from a perception that the country is being harassed by the West

▲ SCUD-B.



▲ Shahab-1.



▲ Shahab-2.

The necessary development of an Iranian satellite launch capability was immediately regarded by the West as a veiled offensive missile programme

In parallel with these developments, there was a constant, diplomatic endeavour to solve the problems – in effect, the deal was that if Iran ceased nuclear weapons development the sanctions would be lifted. As a result, the Joint Comprehensive Plan of Action (JCPOA) was signed in 2015 (under President Obama), which could have led to the suspension of sanctions. However, in 2019, the United States unilaterally cancelled the JCPOA (under President Trump) and more intensive unilateral sanctions came back into effect.

All this has led to a deterioration in the political field (in that not all signatories of the JCPOA agree with the American decision) and the economic field (Iran's economy is heading for a meltdown); there is also a lack of clarity about the status quo (Iran is now, in strategic areas, 'going underground'). The relevant issue here is the overlap between Iran's military ballistic missile programme and its development of independent access to space.

Iran's missile programme

In 1974, Iran founded its Defence Industries Organization under the Iranian War Ministry and began developing and testing short-range unguided artillery missiles. The plan to build and expand a missile capacity was further consolidated through cooperation with Israel which, before the fall of the Shah regime in 1979, was involved in a billion-dollar project to adapt modern ground-to-ground missiles for sale to Iran. This project, named Project Flower, was one of the six oil-for-arms contracts signed in Tehran in 1977. Iran and Israel did not have diplomatic ties at the time, but there was plenty of trade and both countries benefitted from Project Flower. For Israel in particular, the guaranteed supply of oil from an important Muslim country was paramount.

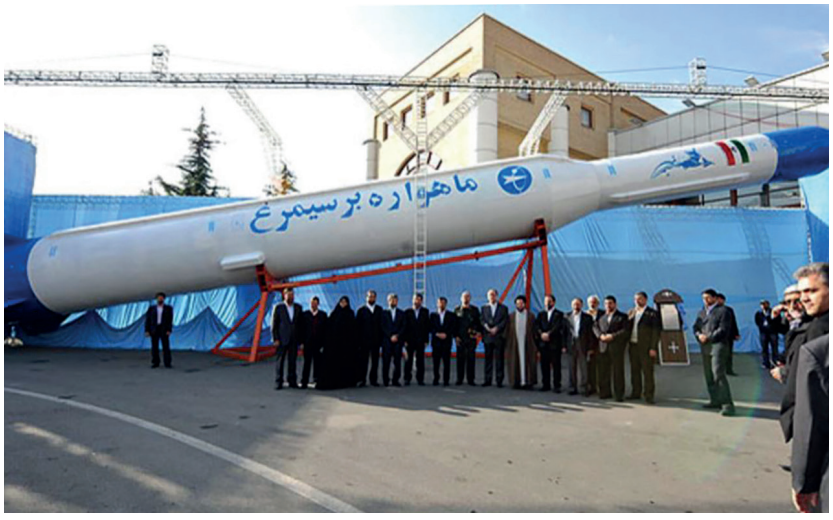
However, the Islamic Revolution of 1979 changed all that and the partly-paid-for ground-to-ground rockets were never delivered. The Islamic Revolution was a turning point for Iran in many ways, with major changes, not only in domestic and foreign politics, but also in defence strategy. While Iran was almost entirely

dependent on the US and Europe for weapons, the new republic could suddenly no longer buy weapons, ammunition and spare parts there. Military training programmes were stopped and foreign advisers and technicians were recalled. Iran's military industry was still in its infancy and time was needed for technological development, training and infrastructure development. When the war with Iraq broke out, the Iranian military lacked almost everything because - as a consequence of the revolution - domestic politics had been given priority.

At the beginning of the war, the weakened Iranian air force was unable to protect the army and civilian population from Iraqi attacks with planes and missiles. This led to the notion that Iran's rocket capacity had to be scaled up quickly, so Iran started importing SCUD-Bs from Libya, Syria and, later, North Korea. SCUD-Bs were tactical ballistic missiles developed by the Soviet Union and frequently exported to friendly countries; however, these liquid propellant rockets were inaccurate and did not represent much militarily. The missiles were mainly used because their unpredictability caused fear among military forces and the population. They were therefore a morale boost for the Iranians who could finally retaliate against Iraqi strikes.

From 1985 to 1987, Iran purchased 20 SCUD-Bs from Libya, 12 from Syria and 120 from North Korea, including all necessary items to deploy the missiles. Between 1988 and 1994, Iran purchased another 150-200 SCUD-Bs from North Korea and launched almost 100 against Iraq in the Iran-Iraq war. The multi-million dollar contract with North Korea was the start of years of military

▲ Shahab-3 on view to the public in Teheran.



▲ Simorgh Iranian space launch vehicle.

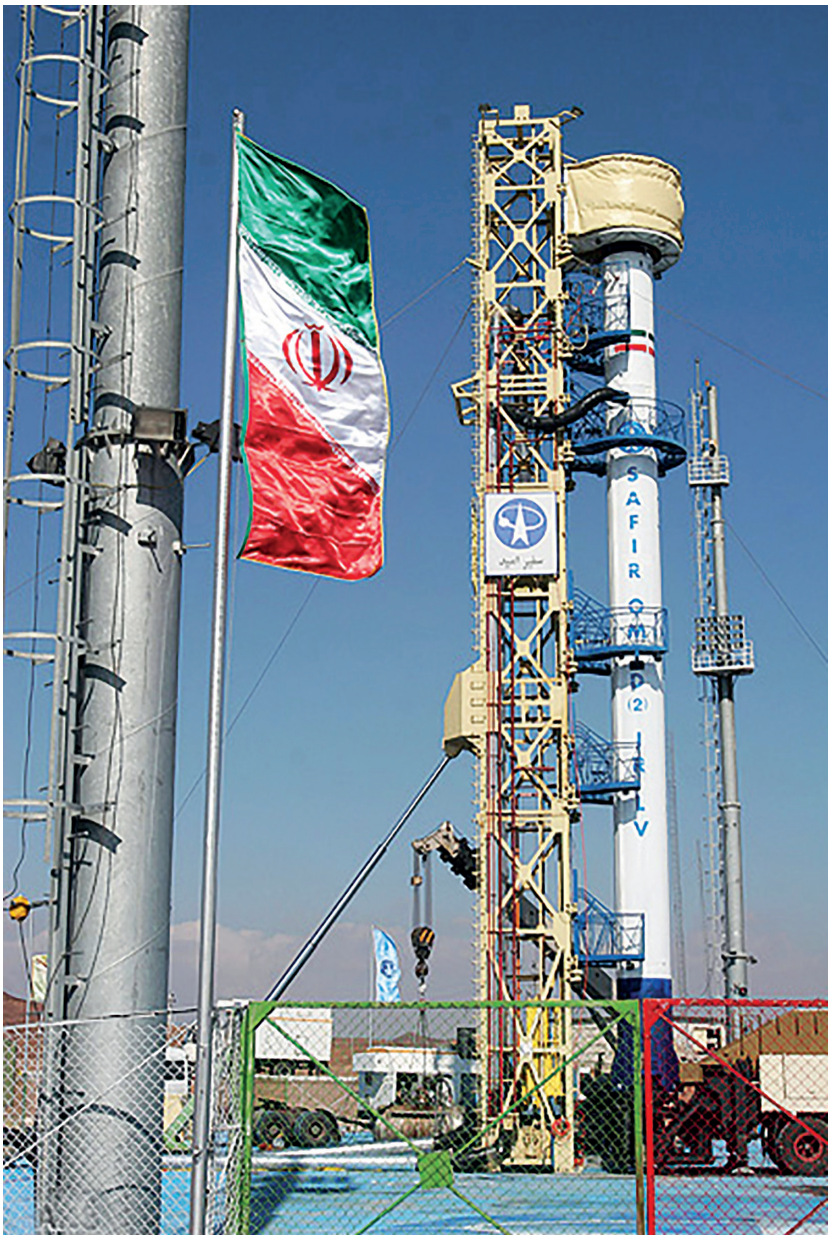
Iran's ballistic missiles and space launch vehicles.

Name	Range (Km)	Payload (Kg)	Assessed operational capability	Rocket type
Shahab-1	290-330	985	1985	Short range ballistic Missile
Shahab-2	500	700	1997	Short range ballistic Missile
Kavoshgar-1	Suborbital	<350	2006	Space launch vehicle
Ghadr-1	1,900	800	2007	Medium range ballistic Missile
Shahab-3	1,300	1,200	2007	Medium range ballistic Missile
Safir-1	Orbital	65	2009	Space launch vehicle
Emad	1,700	750	2015	Medium range ballistic Missile
Qiam-1	700	500	2017	Short range ballistic Missile
Simorgh	Orbital	350	To be decided	Space launch vehicle

cooperation and technology exchange between the two countries and resulted in an Iranian industrial infrastructure that could build and deploy its own version of the SCUD-B. It named it the Shahab-1.

The Shahab-1 is almost identical to the North Korean Hwasong-5, differing only in the use of parts and materials. It is almost 11 m long with a diameter of 88 cm and the launch weight is approximately 5800 kg. Its range depends on the warhead – which can be tactical atomic bombs, chemical or biological weapons or hi-explosive warheads - and is between 290 and 330 km. Iran tested an improved version of the Shahab-2 in 2010, which it called the Qiam-1. This rocket, which can launch a 750 kg warhead over a distance of 700-800 km, was used in combat operations in Syria against ISIS.

▼ Safir Iranian space launch vehicle.



In the mid-1990s, Iran purchased the North Korean No Dong-1 rocket and used it to develop its first Medium Range Ballistic Missile (MRBM) called Shahab-3, which became operational in 2003. An operational range of around 1300 km puts Israel and western Saudi Arabia within reach. Further new versions were announced by Iran with designations including Shahab-3A, -3B, -3D and -3M, or with names such as Qadr-1, Ghadr-1 (2007) and Emad (2015).

Most importantly for the current discussion, the Shahab-3 has been used as the basis for Iran's space launch programme, using names such as Kavoshgar-1, IRIS and Safir.

Iran's space programme

Much of Iran's development of ballistic missiles and space launchers is still shrouded in secrecy. The development of its own space launch vehicle, which could be used to launch its own satellites, began after the establishment of the Iranian Space Agency in 2004. On 25 February 2007, Iranian state television announced that "a spacecraft missile with an unspecified payload was successfully launched". This is considered to be the inaugural launch of an Iranian space-related missile, although Iranian President Ahmadinejad later stated that the launch had failed. In fact, Iran had already launched a satellite (Sina-1) using a Russian vehicle launched from Plesetsk on 27 October 2005.

Iran began its space launch experience with sub-orbital sounding rockets, the first of which was the Kavoshgar-1 launched on 4 February 2008. This two-stage solid propellant rocket had a scientific payload that reached a height of around 200 km and made measurements in the atmosphere on its return to Earth. Until 14 December 2013, at least seven Kavoshgar sounding rockets were launched, most of which had a biological payload, often with rodents and turtles on board but also with monkeys. This made Iran the sixth country to conduct experiments with animals in space.

The launching of satellites into orbit was first tested on 2 February 2009, when Iran succeeded in orbiting a working satellite called Omid. As mentioned above, the Safir rocket used for this launch was derived directly from the Shahab-3; in fact, the Safir is a Shahab-3 rocket with a small second stage. The Safir is 22 m long, has a diameter of 1.25 m and a launch weight of about 27

tonnes; it is capable of placing 50 kg satellites into 300 km orbits.

A second space launch vehicle developed by Iran is the Simorgh, a two-stage liquid propellant rocket for launching 250 kg satellites into 500 km orbits that can also be equipped with a third stage. It is 27 m long and has a launch weight of 70-87 tonnes. After a first sub-orbital test in 2016, two failed launches followed: the first, on 27 July 2017, carried the Toloo satellite and suffered a second stage failure, while the 15 January 2019 launch of the Payam satellite suffered a third stage failure.

Dual-use controversy

It is well-known that many states have developed ballistic missile (BM) technology since the Second World War and that several have converted BMs into space launch vehicles (SLVs) or developed both technologies in parallel. This is a prime example of dual-use technology.

However, SLVs have never been converted into BMs, which need sufficient speed (4 to 7.8 km/s) to inject the warhead into a ballistic trajectory that leads to a ground-based target. To increase the range, this trajectory often goes through space (which is generally thought to begin at an altitude of 100 km). To return through the atmosphere without burning-up, specific re-entry technology is required, technology which was tested by Iran with its Kavoshgar sounding rocket launches. SLVs require a much higher velocity (~ 9.3 km/s) to orbit a satellite. BMs are often solid-propellant rockets (which can be moved and launched quickly), while SLVs are generally liquid-propellant rockets (which, while being more efficient, are more difficult to prepare and require propellants to be loaded and pressurised shortly before launch). The SCUD, however, uses simpler, non-cryogenic propellants, namely kerosene and nitric acid. The difference between BMs and SLVs is therefore mainly in the mission - warhead versus satellite – and the rockets are not instantly interchangeable.

On 3 January 2019, America's foreign minister, Mike Pompeo, announced that Iran was getting ready to launch several SLVs. He also claimed that these SLVs used almost the same technology as ballistic missiles and were therefore a threat to international security. This claim is not entirely true, but not entirely false either.

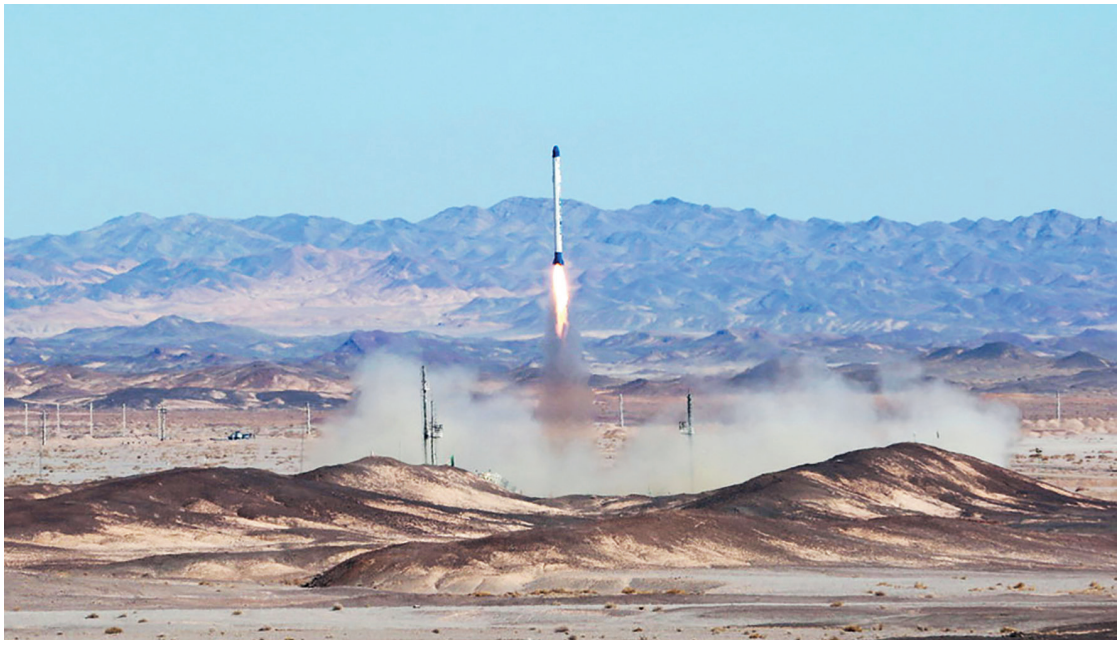
Iran's missile programme is based on the Soviet SCUD ballistic missile that Iran bought mainly from North Korea in the 1980s. The SCUD system has been developed by countries such as Iran, Iraq, Pakistan and North Korea into offensive missile systems for warfare, and modified by Iraq and North Korea to provide longer range by clustering and stacking. Iraq's Al Abid modification came to nothing, but North Korea's Taepodong forms the basis of its current Hwasong-15 rocket system with a theoretical maximum range of 13,000 km that would allow it to reach the mainland of America.

Iran developed two SLVs, Safir and Simorgh, in the same way, by extending and stacking with their Shahab-3. Both SLVs are liquid-propellant two-stage rockets, which makes them less suitable as tactical ballistic missiles. However, North Korea sold the Hwasong-10 BM system (with a maximum

Much of Iran's development of ballistic missiles and space launchers is still shrouded in secrecy

▼ Iranian Shahab volley launch.

Mike Pompeo's concern for a threat to international security, based on current SLV technology, is therefore unfounded



▶ Iran's Safir rocket lifts off in February 2015 carrying the country's fourth experimental satellite.

range of 2500 km) to Iran, which they renamed Khorramshahr, so the nation has both a space launch vehicle and a viable ballistic missile system.

Emerging space state?

Iran continues to develop and produce short-range and medium-range ballistic missiles, but it is not following the North Korean path of making very-large-range military missiles - instead adhering to a self-imposed maximum range of about 2000 km. That said, cooperation with North Korea and testing of the Khorramshahr means that Iran must be deemed capable of developing an intercontinental ballistic missile (ICBM).

▼ Artist's concept of Iran's indigenous Mesbah-2 satellite. Plans for placing it into orbit were cancelled two years ago.

If Iran actually pursues an ICBM, it will not be developed from SLV technology, because current Iranian SLVs are based on much older SCUD technology that is unsuitable for ICBMs. Also, there are no indications that Iran is developing an SLV capacity based on Khorramshahr technology in order to get an ICBM that way.

So although Iran's BM programme may already be a threat to peace in the Middle East, Iran's SLV programme is not: the Iranian SLV programme is focused on technology that is certainly not ideal for long-distance military applications. Mike Pompeo's concern for a threat to international security, based on current SLV technology, is therefore unfounded. However, although it seems far-fetched to characterise Iran's space activities as a secret BM programme, that does not alter the fact that developments in Iranian rocket technology will make ICBM production possible in the future. ■

About the author

Henk Smid is retired field officer of the Royal Netherlands Air Force, space analyst and publicist of numerous space related articles. He has been advisor to several national and international organisations on space-related subjects for which he has prepared a range of space analysis and projections. Smid is a co-author of *The New Space Programs of Asia, the Middle East and South-America* (Springer, ISBN 978-1-4419-0873-5).

Acknowledgment

Translated from the article 'Ruimtevaart in Iran' first published in Dutch in Ruimtevaart magazine, The Netherlands, 2020. The article uses, among other open sources, the IISS Strategic Dossier: 'The International Institute for Strategic Studies, Iran's Ballistic Missile Capabilities, A net assessment', London, UK, May 2010, ISBN 978-0-86079-205-5.