Published on **Breaking Defense** on 2 October 2024

What is the Fath-360, Iran's ballistic missile now arming Russia?

Missile analyst Ralph Savelsberg breaks down public information about Iran's Fath-360 ballistic missile and how it might be used by Russia against Ukraine.

By Ralph Savelsberg on October 02, 2024 at 12:04 PM

Iranian President Masoud Pezeshkian meets with Russian Prime Minister Mikhail Mishustin in Tehran, Iran on September 30, 2024. (Photo by Iranian Presidency / Handout/Anadolu via Getty Images)

Several weeks ago, reports revealed that Iran has been delivering Fath-360 missiles to Russia. It was an announcement that raised eyebrows and alarm bells among pro-Ukraine nations, but how much will the missile actually change Russia's military calculus?

Iran claims that this missile has maximum range of 120 km, with a 150 kg warhead. Computer simulations, based on Iranian information and video analysis, indicate that this claimed range is plausible. However, as such, this missile does not add a radically new capability to Russia's military: Its range and payload are comparable to that of existing Russian artillery missiles, which Russia has used against Ukraine, particularly the 9M54 family. Furthermore, a comparison of the specifications shows that these Russian missiles are more accurate and spread their effect over a larger area by using sub-munitions.

Why then, would Russia buy weapons from Iran which do not fit their existing launchers and for which Russia does not yet have a logistics chain? The answer is likely two-fold. First, Russia's own industry may not be able to meet its military's demand and, although the Iranian missiles may be less capable, they may still be suitable against some targets. And second, any weapon that can be used forces Ukraine to expend valuable air and missile defenses.

One note: There are no signs the Fath-360 was used in this week's Iranian attack on Israel, likely due to the distance from the Iranian launch sites to their targets.

What Is The Fath-360?

Several weeks ago, US secretary of State Blinken stated that Iran has been delivering Fath-360 ballistic missiles to Russia and that Russia was expected to start using them within weeks. Iran denied this and, at the time of writing, there is no direct evidence in the public domain of Russia using such missiles. However, it is abundantly clear that, after having sold UAVs to Russia, Iran has also been eagerly marketing its ballistic missiles to Moscow.

For instance, at the ARMY 2023 exhibition in Moscow, in August 2023, Iran had a large delegation and a stand displaying Iranian weapons including several models of ballistic missiles. Sergei Shoigu, then the Russian Defense Minister, visited the stand. Iran again had a stand at this year's event, which displayed both UAVs and ballistic missile models, as reported by Breaking Defense.

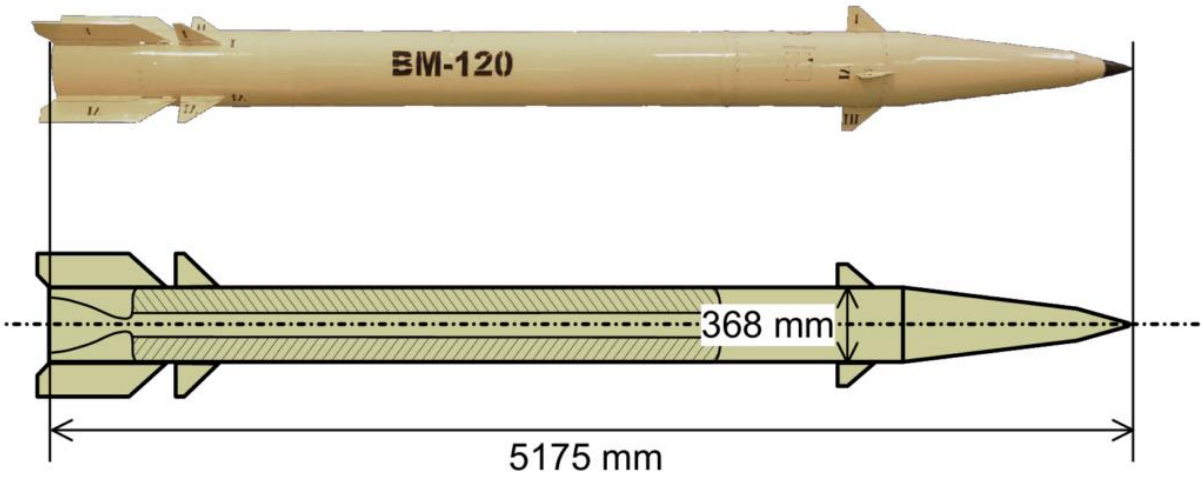
Iran started developing solid-propellant ballistic missiles around 1990, with the unguided Zelzal artillery rocket. That first weapon was rail-launched, with the angle of the rail determining the missile's trajectory and impact point. To improve the accuracy of such missiles, Iran subsequently developed the Fateh-110. This is also rail-launched, but fitted with a navigation system and four aerodynamic control fins near the missile's nose. These correct the missile trajectory for, for instance, the rail being misaligned and for wind. The navigation system uses a combination of inertial navigation and satellite navigation. Over time, Iran developed different versions with ranges up to 300 km. (Reportedly, Iran has supplied the Fateh-110 missile type to Hezbollah.)

In turn, the Fateh-110 spawned a family of rail-launched solid-propellant missiles of various sizes and ranges. These include further improvements such as lighter casings and more energetic propellant. The largest and most advanced versions have separating re-entry vehicles and ranges of up to 1,450 km. The Fath-360, which is also marketed as the BM-120, is one of the smallest versions. It was unveiled in 2020 and saw combat use in 2022 in Iranian strikes against Iraqi Kurdistan. Because it is compact and uses solid propellant, this type of missile may also be suitable for use by Iranian proxies such as Hezbollah and the Houthis.

	BM-120	9M544	9M549
Maximum range [km]	120	120	120 (possibly 200)
Diameter [mm]	368	300	300
Length [mm]	5175	7600	7600
CEP [m]	30	7-15	7-15
Warhead type	unitary	522 submunitions	72 submunitions
Warhead mass [kg]	150	125	unknown
Take-off mass [kg]	787	815	828
Maximum Mach number [-]	4	unknown	unknown

BM-120/ Fath-360 specifications from the Export Center of the Ministry of Defense of the Islamic Republic of Iran and specifications for the Russian 9M544 and 9M549 artillery rockets from Armament Research Services and TULA news.

The Export Center of the Ministry of Defense of the Islamic Republic of Iran has published specifications, including the missile's mass, length and diameter, as well as the claimed maximum range of 120 km (hence BM-120). The claimed maximum velocity is Mach 4; four times the speed of sound.



BM-120/ Fath-360 image compared to reconstruction. Original image: Export Center of the Ministry of Defense of the Islamic Republic of Iran

The Export Center also published an image of the missile and of a missile launch vehicle. The proportions of the missile in the image correspond to the published specifications. It is smaller, but has a similar overall configuration as the Fateh-110, with two sets of cruciform stabilizing fins near the tail and four control fins just aft of its nosecone. As on the Fateh-110, these do not lie in the same planes as the tail fins, but have a 45-degree offset.

Two different Iranian launch vehicles for Fath-360 missiles, with launch canisters with cylindrical (a) and square (b) cross-sections. Image credit: FARS News & Mashreghnews.ir

The launcher carries six missiles in individual launch canisters. These canisters have frangible covers, which suggests that they are also used to transport the missiles. Therefore, reloading the launcher likely requires a crane to stack individual canisters on the launcher with the missiles inside them. This is similar to, for instance, US Patriot surface-to-air missiles.

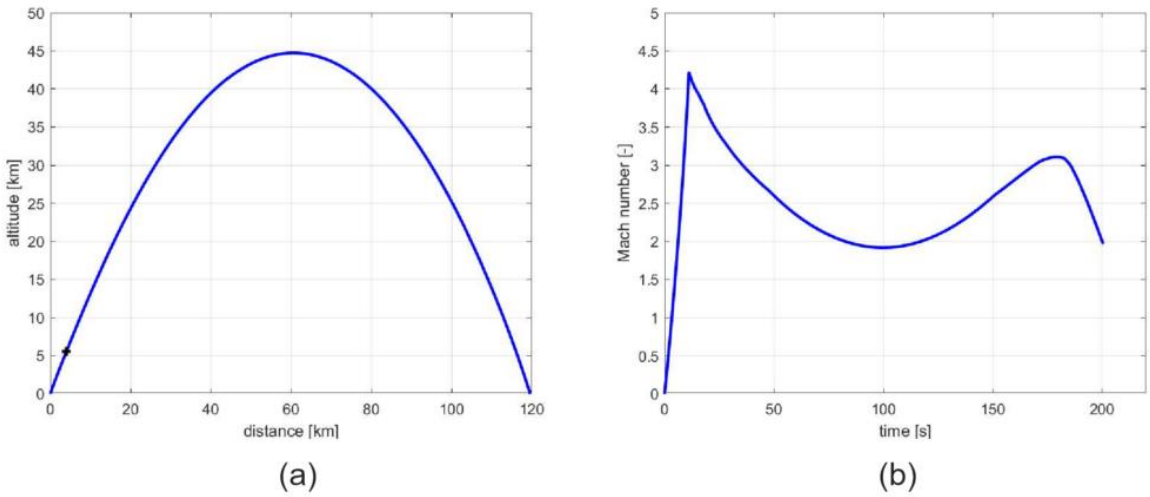
There are at least two canister designs with either a square or a circular cross section. Because the missile's fins do not fold, depending on whether the canister has a square or circular cross section, its diagonal or diameter has to be larger than the span-width of the fins. Based on a comparison with the size of the truck, the canisters are slightly longer than the missile.

The launch vehicle is an IVECO Trakker with a trainable launcher mounted on the back. This elevates the launch canisters to the angle required for the desired range. IVECO is a Turin-based manufacturer that had (and may still have) an agreement with the Iranian vehicle builder Zamyad for assembling IVECO trucks in Iran. This type of commercial truck chassis is typically used for tipper trucks or concrete mixers, so it has limited off-road ability and its cab offers very little ballistic protection. The Iranian trucks are fitted with covers that can slide aft to disguise them as regular commercial trucks.

Fath-360 Performance

The specifications published by Iran are insufficient to assess whether the missile can fly the claimed 120 km. The propellant mass, propellant specific impulse (a measure for how much thrust the propellant can generate) and the missile burn time are missing. Fortunately, a published video of the launch of a Fath-360 allowed measuring the missile position in individual frames as a function of time, since the length of the missile and the video frame rate are known. Combined with the angle of the launcher, this provided a relation between the missile's mass and its thrust.

The missile's aerodynamic properties were derived from the image published by the Export Center. An estimated specific impulse of 250 s is suitable for the claimed propellant. Computer simulations of maximum-range trajectories as a function of the propellant mass, with the burn time adjusted such that the acceleration matched the measurement from the video, showed that the claimed range requires a propellant mass of 373 kg. Given the size of the rocket motor, this is reasonable. Since the missile warhead reportedly has a mass of 150 kg, this leaves 264 kg for the mass of the missile airframe, including the engine casing and the guidance equipment. Given its size, this is a reasonable number too. Thus the claimed 120 km-range is plausible.



Simulated maximum-range trajectory (a) and Mach number as a function of time (b).

The simulations show that on a maximum-range trajectory, the missile reaches a maximum altitude of close to 45 km. At burnout, the missile reaches a speed equivalent to four times the speed of

sound, or Mach 4, as claimed by Iran. The missile subsequently continues to gain altitude, losing velocity until it reaches the highest point at 100 seconds into the flight. After this, it starts to fall down and gains velocity, which peaks at close to Mach 3. During the final phase of the flight, due to increasing air density at lower altitudes, the missile again sheds velocity, hitting the target at Mach 2. The total flight time to 120 kilometers is close to 200 seconds.

Iran claims a Circular Error Probable (CEP) of 30 meters. This is the radius around a target within which 50 percent of the projectiles launched at that target land, so it is a measure of the missile's precision. The Iranian claim is plausible. In their 2020 attack on US facilities at Al Asad AB in Iraq, in which they used missiles with maneuverable re-entry vehicles that also navigated using a combination of satellite and inertial navigation, they demonstrated a CEP of several tens of meters. To do significant damage to targets such as bridges or armored vehicles, a 150 kg warhead will have to hit within a few meters, however, so this CEP is only good enough to hit relatively large or soft targets. Otherwise, at least one landing close enough to do significant damage will require multiple projectiles. In Ukraine, the CEP likely will be significantly worse, since satellite navigation systems in Ukraine are being jammed to address the threat of drones.

The Fath-360 Compared To Other Russian Missiles

Russia has been using the SS-26 "Stone"/ Iskander-B ballistic missile against Ukraine, with a reported range of close to 500 km. With its 120 km-range, the Iranian missile may help Russia 'preserv[e] its longer-range capabilities for use throughout the battlefield', as a Pentagon spokesperson put it.

However, Russia already has a missile system for similar shorter ranges. The Russian military has a history of using rocket artillery dating back to World War II, when the Soviet Army used Katyusha rockets. These had a poor CEP, but they were inexpensive and were fired in large numbers, to compensate. The most modern Russian artillery rockets belong to the 9M54 family and Russia has used these in Ukraine. Different versions have ranges of up to 120 km (or even 200 km). To improve their precision, depending on the particular version, these too use inertial and satellite navigation (in particular the Russian GLONASS system) and have nose-mounted control fins.

Reportedly, the control fins can also make the missiles maneuver such that their final descent towards their targets is nearly vertical, making them harder to intercept. The missiles are longer and narrower than the Fath-360 and they have folding fins, so they take up less space in transit. Instead of a single warhead, the 9M544 and 9M549 missiles carry sub-munitions, spreading their effect over a larger area. Reportedly, the 9M544 carries 522 dual-purpose sub-munitions, suitable against armored vehicles and personnel, while the 9M549 carries 72 high-explosive fragmentation munitions optimized against personnel. Different sources give slightly different specifications, but the missiles are a bit heavier than the Fath-360. Their CEP reportedly is between 7 and 15 meters, which would make them more accurate than the Fath-360.

Since the Fath-360 does not add a significantly new capability to Russia's military, why then would Russia buy Iranian missiles? It suggests that Russia's own industry simply cannot meet the demand for missile systems intended for this sort of range.

Examination of electronics in the guidance section of a 9M544 missile, retrieved in Ukraine, revealed the presence of Western components. When this missile was designed, around the turn of the

century, Russia still had easy access to Western electronics. Some of those components are still available on the civilian market, but Russia may now struggle to buy them in sufficient quantities. There are reports that the deal with Iran does not cover launchers. It would make sense for Russia to fit launchers to trucks already in Russian service, such that they can use the existing logistics chain, but Russia's vehicle supplies may also be running low.

Regardless, despite the Fath-360's drawbacks, it may be suitable against targets such as Ukraine's electricity distribution system or for use as a terror weapon against the civilian population. Furthermore, launching these missiles against Ukraine will force Kyiv to expend more air and missile defense capabilities against less valuable threats. Finally, improvements to these missiles based on the experience of their use in combat, may also help Iran and its proxies elsewhere, which Russia may hope to benefit from indirectly.

Ralph Savelsberg, a member of the Breaking Defense Board of Contributors, is associate professor at the Netherlands Defence Academy in Den Helder, specializing in missile defense. This article does not reflect any official position or policy of the Government of the Netherlands. The author would like to thank James Kiessling and Martin Vermaase for their valuable comments and suggestions.