As we enter an era dominated by drones and artificial intelligence in warfare, a new arms race has emerged—the development of hypersonic missiles. Any weapon capable of travelling at speeds exceeding Mach 5, or five times the speed of sound, falls under the category of hypersonic weapons. The primary advantage of these missiles lies in their extreme speed and manoeuvrability. At such high velocities, they become incredibly difficult to detect, and even if identified, intercepting and neutralizing them remains nearly impossible.

Currently, four countries have successfully developed hypersonic missile technology: the United States, Russia, China, and India. While all these nations claim to possess operational hypersonic weapons, Russia is the only country reported to have used them in active combat, specifically in the ongoing Ukraine conflict. According to publicly available sources, Russia deployed the Kinzhal (Dagger) Kh-47M2 missile, which is believed to reach speeds of Mach 10 and has an estimated range of around 470 kilometres. However, the missile has been used sparingly, likely due to its prohibitively high cost of approximately $10 million per unit.

***The high cost of these advanced weapons is a significant limiting factor in their widespread use***. However, as technology progresses and production scales up, costs are expected to decrease over time. Within the next decade, it is anticipated that advancements in propulsion technology, particularly scramjet engines—the core component of hypersonic missiles—could enable speeds of up to Mach 17. While this remains below the orbital velocity of Mach 25 achieved by rocket engines, the fundamental difference between the two lies in their operational environments. Rockets are designed for space travel and rely on onboard oxidizers, whereas scramjet-powered hypersonic missiles operate within the Earth's atmosphere, drawing oxygen from the air for combustion. This distinction allows scramjets to be more compact, as they do not need to carry their own oxygen supply.

The guidance system serves as the "brain" of a hypersonic missile. Traditionally, these weapons rely on satellite-based navigation, but recent advancements in artificial intelligence have introduced AI-driven guidance systems. ***These systems can pre-program target coordinates and autonomously adjust the missile's trajectory with pinpoint accuracy. This independence from external tracking aids—such as satellites***

*or ground-based radar—enhances the missile's ability to navigate contested airspace, where electronic warfare techniques like radio jamming are prevalent*.

Hypersonic weapons can be armed with either nuclear or conventional warheads, depending on strategic requirements. Their destructive potential is widely acknowledged, yet defence systems capable of identifying and neutralizing these threats remain underdeveloped. *While the technology behind scramjet-powered missiles is complex and difficult to master, the risk of their proliferation into the hands of rogue states or terrorist organizations continues to be a major global security concern.*