

Hypersonic Weapons: The Perfect Tool for Asymmetrical Warfare

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As recently confirmed in a [debate](#) at the Brookings Institute by the Commandant of the United States Marine Corps, General Robert Neller, “there are military areas in which the United States maintains a technological advantage [over Russia and China], others in which there is substantial parity, and others in which the United States is lagging behind, revealing a technological gap with its peer competitors”.

The last point applies to weapons systems designed to operate at hypersonic speed. Let us start with the simple and pragmatic definition offered by [The National Interest](#) of hypersonic vehicles and weapons:

A hypersonic vehicle is one that moves through the atmosphere at a minimum speed of five times that of sound, or Mach 5. A hypersonic cruise missile travels continuously through the air employing a special high-powered engine. A hypersonic glide vehicle [HGV] is launched into space atop a ballistic missile, after which it [maneuvers](#) through the upper reaches of the atmosphere until it dives towards its target. Both vehicle types can carry either conventional or nuclear weapons.

As we can see, we are speaking here about technological developments that require money and scientific structures of the highest level to achieve such significant and complex results. The difficulty of implementing systems of such complexity is very well explained by [Defense Review](#):

One of DR’s primary questions about the Russian and Chinese HAA/HGV [Hypersonic Attack Aircraft/Hypersonic Glide Vehicle] tech is whether or not the vehicles generate a [plasma field/shield](#) around it that can effectively camouflage the vehicle and/or disrupt an incoming high-powered laser beam, and thus avoid both detection and destruction during its flight. Russian scientists and military aircraft designers/developers [have been experimenting with plasma field generation tech since the late 1970’s](#), so one would think they’re pretty far along by now. Oh, and let’s not forget China’s recent development of a [new ultra-thin, lightweight “tunable” UHF microwave radar-absorbing stealth/cloaking material for both manned and unmanned combat aircraft and warships](#). The hits just seem to keep on coming. Its enough to drive a military defense analyst to drink.

Another area of complexity concerns the communication between the hypersonic flight carrier and its land-based components, especially if the re-entry vehicle is to be maneuvered remotely.

The fundamental component in performing a hypersonic flight naturally lies in the engines, used to reach speeds higher than Mach 7. There are [ongoing studies](#) by all of these countries concerning scramjet engines, essential for the purposes of producing hypersonic weapons. By employing a [scramjet](#) engine, and mixing it with other technologies (jet engine or ramjet), one would enable the aircraft and missiles to reach hypersonic speeds, as [Beijing's Power Machinery Research Institute](#) explains:

The turbo-aided rocket-augmented ram/scramjet engine (TRRE), which uses rocket augmentation to aid the transition into the supersonic and hypersonic flight regimes, could be the world's first combined cycle engine to fly in 2025, paving the way for hypersonic -space planes and single-stage space launchers.

[DARPA](#) also explains the US point of view on this particular area of research:

Advanced Full Range Engine program (AFRE) which is intended as a reusable hypersonic engine that combines an off-the-shelf jet engine with a dual mode ramjet engine.

[War Is Boring](#) definitively clarifies the concept using simpler words:

Turbojet? Ramjet? Scramjet? A turbojet spins a lot of blades to compress and heat incoming air. A ramjet moves so fast that the engine is already hot and compressed enough to ignite the fuel. A scramjet – short for “supersonic combustion ramjet” – is just that, a ramjet where the incoming air is moving at supersonic speeds.

The world of hypersonic weapons is divided into four types: hypersonic cruise missiles, which are surface- or air-launched; hypersonic glide vehicles, brought to high altitude by missiles or jets, re-entering the atmosphere at very high speeds while maneuvering, and able to hit targets with conventional or nuclear bombs; hypersonic attack aircraft, which are vehicles that fly at hypersonic speeds and are capable of taking off and landing, and are therefore useful for surveillance purposes but potentially also for attack; and finally, hypersonic anti-ship missiles.

Let's examine them one by one, listing the current respective stages of research, development and testing of the countries in question.

The first type of hypersonic weapons are the easiest to understand. Simply put, these are cruise missiles with scramjet engines that are capable of accelerating to hypersonic speeds.

Hypersonic cruise Missiles (excluding anti-ship weapons available below) United States (testing phase)

- [High Speed Strike Weapon](#) (HSSW), based on the [Boeing X-51](#)

Russia/India (testing phase)

- [BrahMos-II](#) is a hypersonic missile currently under development in India and Russia

The most discussed weapon is the hypersonic glide vehicle (HGV). What exactly a HGV is

can be explained as [follows](#):

HGVs are unmanned, rocket-launched, maneuverable aircraft that glide and “skip” through the earth’s atmosphere at incredibly fast speeds. Compared to conventional ballistic systems, HGV warheads can be much higher, lower altitudes and less-trackable trajectories. The defense systems approach leaves less time to intercept the warhead before it drops its payload.

Glide Weapon/Hypersonic Glide Vehicle:

United States (experimental phase)

- For years, the US has worked on missiles that can be used as a Tactical Boost Glide ([TBG](#)) weapon, which is a rocket glider that can reach speeds of 20,921 kilometers per hour, or Mach 20, and then uses a scramjet/ramjet engine to perform maneuvers. Currently, the United States is in the research and development phase of experimenting with an Advanced Hypersonic Weapon (AHW) known as the Hypersonic Technology Vehicle 2 ([HTV-2](#))

Russia (entering into service in 2019)

- KH-47M 2 Kinzhal ([Dagger](#)). An air-launched, modified Zircon missile launched from a MiG-31.
- [Avangard](#) /YU-74.

China (test phase)

- [DF-17/DF-ZF/WU-14](#) – Hypersonic glide vehicle (HGV) medium-range system, with a range of between 1,800 and 2,500 kilometers.

As we can see, Russia is almost ready to start mass production of their HGVs, while the US is still in the early phase of experimentation, and China is already undertaking numerous tests.

The most complicated factor with hypersonic technology concerns the Hypersonic Attack Aircraft (HAA), equipped with scramjet engines and able to attain hypersonic speeds, but with the added benefit of being able to take off and land. They are to be unmanned and can be used for surveillance or attack purposes.

Hypersonic Attack Aircraft

United States (unknown phase)

- No known projects, much speculation about tests and scientific research. For example, the US military created in 1996 a program called [SHAAFT](#). Now the US Military is working on a number of prototypes:
- [X-51 WaveRide](#)
- [NASA's X-43A](#)

- [SR-72](#)

Russia (testing phase)

- [YU-71 Russia](#)

China (testing phase)

- [TENGYUN](#) is a hypersonic aircraft powered during the first stage by a turbine rocket combined cycle (TRCC) engine, which then launches a reusable second-stage rocket to reach the stratosphere.

Because scramjet technology, on which HAA systems rely, is still in its early phases of development, this weapon system is unlikely to see the light of day any time soon.

Anti-ship missiles accelerate to hypersonic speed, allowing them to hit naval groups. As [described](#) below, this is because of a scramjet motor that gives such missiles their power:

Anti Ship Missiles are believed to be a maneuvering, winged hypersonic [cruise missile](#) with a lift-generating center body. A booster stage with solid-fuel engines accelerates it to supersonic speeds, after which a [scramjet](#) motor in the second stage accelerates it to hypersonic speeds.

Anti Ship Hypersonic Missiles:

United States (Currently only possesses sub-sonic missiles)

- [AGM-158C LRASM \(sub-sonic\)](#)

Russia (operational)

- [3M22 Zircon](#)

China (testing phase)

- [Modified Dong Feng 21](#)

In the next article I will explain how Russia and China Gained a Strategic Advantage in Hypersonic Technology and why this could be a game changer in future war scenarios.

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