

Hypersonic Weapons

A Transition or a Transformation? A Theoretical Approach to Examining Hypersonic Weapons in Contemporary Conflicts

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“Every morning in Africa, a gazelle wakes up. It knows it must run faster than the fastest lion or it will be killed. Every morning, a lion wakes up in Africa. It knows it must outrun the slowest gazelle or it will starve to death. It doesn’t matter whether you are a lion or a gazelle: when the sun comes up, you’d better be running.”¹

This is an African folklore that implies the need to get going. It can also be interpreted as speed being a key to survival. Speed is an important factor in warfighting. It emerges in various dimensions such as responsiveness, operational tempo, etc. The faster one can operate than the enemy, the better the chances of winning. Right from Genghis Khan to Napoleon to the German Blitzkrieg or the First Gulf War, speed has been a decisive factor. Speed can be examined from three dimensions: as the rate of flow of information; the rate of flow of material; and the movement of personnel. The speed of flow of information is one of the core components on which the entire Network-centric Operations are built. It is the speed of the movement of men and material that has delivered favourable outcomes.

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The term 'hypersonic weapon' refers to an object that travels at speeds that are at least five times the speed of sound in air (Mach 5 or above) and that spends most of its flight time inside the Earth's atmosphere (rather than in space), where it can use aerodynamic design features to manoeuvre.² It offers responsiveness, survival (penetrate Anti-access/Area Denial) and precision. The arrival of jet-engine powered aircraft and missiles in the 1940s transformed the way wars were fought. With the introduction of supersonic flights, piston-engined military aircraft became extinct in an operational role. In the decades that followed, no fighter aircraft was propeller-driven. It also altered human mobility. A study finds that between 1951 and 1966, the time taken to travel between two places 2,000 kms apart in the US fell by 41 per cent. During the same period, the US recorded a 30 per cent increase in patent citations.³ The increase in face-to-face interactions that was possible due to a reduction in travel time was found to be a reason for this increase; people met more often. Such discussions altered the research outcomes. However, today there is no need for such high-speed travel since video conferencing is available to discuss and share each other's work in real-time. This leads us to two possible trajectories for hypersonic weapons.

1. The world will move from current supersonic combat aircraft and missiles to hypersonic, indicating a shift like that of the piston to jet engine in the past.
2. This becomes yet another technology in a list of many such technologies that offer an incremental advantage and not a revolutionary transformation.

This commentary examines the trajectories and their impact on contemporary warfare.

THE 21ST CENTURY CHARACTER OF WAR

Warfare has been continuously evolving. While weapons and platforms have rapidly adapted, the methods of employment have largely remained similar to how wars were fought in the 19th century. Most countries have not moved away from the concept of employing massed formations. Massed formations rely on logistics chains. These are orchestrated through command instructions drafted by staff officers working at distant headquarters. Intelligence, Surveillance and Reconnaissance resources have developed and proliferated in the latter part of the 20th century. A mobilisation of this scale cannot be hidden. The First Gulf War of 1991 involved the movement of

430,000 personnel and 5,000,000 tonnes of material into the theatre of operations.⁴ This took six months to build. Warfighting based on such large formations creates vulnerabilities in the long logistics chain. This is evident during the ongoing Russia–Ukraine War, where Russian armoured columns and support vehicles face regular destruction. With the proliferation of drones, Improvised Explosive Devices (IED), etc., these logistics columns are no longer sustainable. Without such long logistics columns, war, as we have witnessed through large-scale formations, is a thing of the past. However, orchestrating such large combined arms is still a part of the doctrines of several armed forces. Referring to the Indian Army, Arzan Tarapore calls this ‘an orthodox offensive doctrine’—a method of using force that favours large formations tasked with punitive incursions into enemy territory.⁵ These were aptly summarised by late Col. John Boyd in his remarks on conflicts of the 19th century as, ‘Huge armies and massed firepower and other vast needs supported through a narrow fixed logistics network, together with tactical assaults by large stereotyped formations, suppressed ambiguity, deception, and mobility and hence surprise of any operation.’⁶

Thus, a violation of the fundamental principles of war by holding onto old and outdated views of warfighting has been detrimental to victory. However, such a poor strategy has also been successful in instances using excess resources. To quote an example, in the First Gulf War, the US alone deployed 1,600 aircraft and flew over 90,000 sorties in 43 days.⁷ The decisive victory masked the huge cost of material at which the victory was achieved.

Concentration, a key principle of warfare of the 19th century, was designed to bring attrition on the enemy. However, today, concentration invites attrition, especially from air power. This realisation is not new and has dominated military thought since the 1940s. This has led to the understanding that ‘control of the air’ is a prerequisite for any military operation. With the proliferation of drones, missiles and electronic warfare equipment in the last five years, air power has become diverse and dispersed. Therefore, it is doubtful if any side can truly achieve the desired degree of control of air, as was seen in the past. During the Israel–Iran conflict of 2025, Iran could still launch missiles and drones on Israeli cities and a US base in Qatar, despite Israel declaring air superiority early in the conflict. Thus, in any war between countries that possess air power, deployment of large massed ground formations in combat, is highly unlikely or a flawed strategy when employed.

Massed surface forces need control of the air to operate. The proliferation and diversification of air power prevents achieving any meaningful control

of the air. Therefore, the conventional means at the disposal of countries are standoff attacks through missiles (air, ground and sea-launched) and air-delivered standoff weapons (Operation Sindoor, Operation Rising Lion, etc.). Russian scholar, Vladimir Slipchenko, described this as Sixth-Generation Warfare—the era of Precision, Non-Contact Warfare.⁸ This implies that countries can go to conflict with each other without the deployment of ground forces. This was observed most recently during Operation Sindoor between India and Pakistan in May 2025 and subsequently between Israel and Iran in July 2025. So, if wars need to be fought from stand-off distances, one needs missiles/drones and aircraft that can deliver the desired impact. Hypersonic missiles are emerging as a promising tool for this purpose.

Responsiveness

Cognitive dislocation is the key to achieving victory in battle. It can be achieved by creating situations faster than the adversary can respond to or cope with. The speed offered by hypersonic missiles can contribute significantly. However, history indicates that the decision to launch takes the most time. Therefore, the speed of the weapon is usually of lesser concern. Thus, for attacking fixed ground targets, the speed of the weapon would not offer any major difference to the outcome.

Speed, however, becomes significant in time-sensitive targeting. The target needs to be neutralised before it changes its position from the last known intelligence input. For time-sensitive targets like an adversary's leadership or mobile long-range air defence systems, hypersonics offer the best speeds and desired precision. This has influenced much of the US hypersonic weapons programmes as an answer to China's Anti-Access/Area Denial (A2AD) strategy.⁹ However, it also needs adequate intelligence. The key to air power is targeting, and the key to targeting is intelligence.¹⁰ Thus, while many countries can acquire and operate hypersonic weapons, their effective use will still be governed by the availability of superior intelligence. Very few countries today possess that level of intelligence.

Survivability: The Weapon that Cannot be Defeated?

The interception of hypersonic weapons is beyond the capabilities of most existing Ballistic Missile Defences.¹¹ The absence of credible defence against hypersonic weapons today tends to build a narrative that it is an ultimate weapon against which there can be no defence. However, all weapons eventually led to the development of their counter-measures as well—nuclear maybe an exception in the physical sense. But nuclear has been prevented

from being employed since 1945 through the use of cross-domain counter-measures like diplomacy.

Edward Luttwak, Senior Associate at the Center for Strategic and International Studies (CSIS), can be considered to have coined the term, 'Countermeasure Holiday'.¹² Countermeasure Holiday is the period between the deployment of a weapon and the availability of its suitable counter-measures. During this period, the new weapon shows disproportionate outcomes. This has been the case with the introduction of planes, tanks, missiles, drones, etc. Douhet, one of the early thinkers on air power, was extremely dismissive of shooting an aircraft in the air from the ground.¹³ But today's air defences have matured to an extent that some claim the capability to create an environment of 'air denial', an aerial space that is unsafe to operate. Trenchard, the founding chief of the Royal Air Force at the end of the Second World War, opined that manned aircraft are no longer required since missiles will do the job. This was based on the experience of V-1 and V-2 missiles employed by Germany and the kind of air defence guns of that era. However, shortly after the jet engine-powered fighters were introduced, it became possible to shoot down these missiles. During the Israel–Iran conflict in July 2025, Iranian surface-to-surface missiles could not do any significant damage, whereas Israel and the US caused considerable damage, using air-deployed weapons.

Thus, every platform/weapon, for a certain period, delivers outstanding results. Hypersonic is possibly no different. The current arguments about the survivability of hypersonic weapons are likewise temporary. Upgrades by the US Navy to Aegis Systems have successfully performed interceptions of hypersonic weapons in live simulations.¹⁴ THAAD is also claimed to be capable of intercepting hypersonic weapons. Programmes to develop significant defences against hypersonic weapons are in progress across the globe. The US Golden Dome aims for defence against hypersonic weapons as well.¹⁵

Today's aerial threats range from drones to ballistic missiles. Their speeds vary from hover to hypersonic. In this environment, hypersonic missiles add one layer of complexity to existing air defence problems.

Destruction: Payload Considerations

The final step in target destruction can emerge from the amount of explosive content and the speed of impact. Some hypersonic weapons do not contain explosives and rely purely on the kinetic impact, like the US Air-Launched Rapid Response Weapon AGM-183A (ARRW). Any form of conventional

warhead on a hypersonic weapon produces destruction similar to that of any other weapon that is available at present. Ballistic missiles with Manoeuvrable Re-entry Vehicle (MARV) warheads have been proven to be 30 per cent cost-effective than hypersonic missiles in a similar setting.¹⁶

HYPERSONIC WEAPONS THROUGH THE PRISM OF DISRUPTIVE INNOVATION

Clayton Christensen coined the term ‘Disruptive Innovation’ in his seminal work, *The Innovator’s Dilemma*, to distinguish between normal and disruptive innovation. To qualify as a disruptive innovation, the innovation must meet the following parameters:¹⁷

1. It must have a unique capability that nothing else possesses.
2. Its initial performance is usually inferior to that of the existing ones.
3. These products typically find acceptance in underserved markets first, or are called ‘fringe’.
4. The trajectory of improvement is rapid from initial launch.

There is no unique capability that the hypersonic weapons possess—whatever they can do, can also be done by other weapons. Secondly, the initial performance appears to be better than existing ones. Thirdly, unlike drones, which were embraced by the ‘fringe’, or countries without a significant military industrial complex, hypersonics are still the forte of established players. Finally, the trajectory has been slow, from the first hypersonic manned flight in the 1960s to almost negligible improvements now. Therefore, hypersonic weapons and platforms do not seem to meet the above four criteria. Thus, they can be classified as an incremental improvement and not something revolutionary, despite the significant technological challenges that have been overcome.

If hypersonics offer only marginal improvements, then why are they still being pursued? There are three possible reasons.

War as a Performance Spectacle

Since 1991, war footage has been delivered to the public in near real-time. There is a line of thought that war has become a performative spectacle and a tool for signalling rather than direct physical impact.¹⁸

The recent Israel–Iran conflict had a stark difference in the war aims when inferred from the media releases. Israel’s videos showed the destruction of ground targets in Iran. It never showed any aircraft taking off or in

flight from Israel. On the contrary, Iran published videos of missiles being launched. No evidence of hitting specific targets was shared by Iran. Some videos did show the missiles impacting cities, but no specific target could be inferred. Both countries celebrated the attacks as a success. This demonstrates one important aspect of the difference in war aims: While for Israel, it was important to destroy targets of value, for Iran, a mere show of survival with the ability to launch a response, was adequate. It is here that hypersonic missiles offer value. If some harm is the only need, then any weapon that can land on the adversary is good. With the current capabilities in Ballistic Missile Defence, hypersonic missiles can temporarily be considered as unstoppable weapons. Therefore, for the domestic audience, an assurance of a spectacle is the ultimate insurance.

Easier to Copy and Produce

The aero-engine (jet) is one of the most complex pieces of engineering the world has produced. Thus, only a handful of countries are capable of designing and manufacturing it. Even countries with a strong automotive industrial base like South Korea, Germany and Sweden, have not been independently successful in the manufacture of modern jet engines. Jet engines are the heart of modern aircraft and cruise missiles. Therefore, the production of these is also similarly restricted. However, on the other hand, rockets and ballistic missiles are comparatively easier to manufacture due to lesser number of moving parts, limited duration of operation and one-time use. Being simpler, they have proliferated to several countries and non-state actors like Hamas and the Houthis. While air-breathing engines powering hypersonics are complex to make, rocket engines are relatively simpler and can be copied and reproduced by a larger number of countries. Thus, it would be a worthy weapon for a dictator who would aspire to acquire it.

FOMO: Fear Of Missing Out

There are times when there is a race to develop weapons, irrespective of their relevance to a country. There is also a possibility that a breakthrough in the future may bring with it some previously unforeseen characteristics that will be truly revolutionary. Therefore, there is an effort in many countries to pursue hypersonic technology as indicated by the US, Russian, Chinese, Indian, Iranian, North Korean, French and British plans. This is despite the observations that hypersonic weapons cost a third more than

the existing weapon systems, to produce the same effect. It is believed that there were at least nine different hypersonic programmes underway in the US.¹⁹ Subsequently, two of these have been cancelled, and one has been re-launched.²⁰ Therefore, hypersonic weapon programmes have not always been driven by a deep study of the environment, threat perception and technology. It could be as simple as following the crowd.

While hypersonic weapons are a significant technical marvel, their influence on battlefield outcomes is neither unique nor exemplary. Unconventional approaches—as demonstrated by Ukraine in Operation Spider Web and Israel in Operation Rising Lion—did offer the surprise, range and penetration of well-defended targets. The results were achieved without resorting to long-range missiles and hypersonic weapons. Therefore, hypersonic weapons currently possess no disruptive or significantly unique capabilities.

CONCLUSION

The literature on warfighting in the last two centuries has been dominated by Western military thought, which is dependent on firepower and speed. These have led to the need for bigger and faster weapons that travel farther and can unleash large-scale destruction. This led to the development of the atomic bomb and the Inter-Continental Ballistic Missile (ICBM). Hypersonic weapons are the natural outcome of this process. Yet, these are still weapons of war from an earlier era—the industrial era of war. This was a very narrow phase of history where firepower and attrition battles dominated the battlefield, that is past its time.

Great powers are also nuclear powers that cannot be reasonably expected to fire such weapons at each other. Yet, competition and conflict between them cannot be ruled out. Though firepower still has a role, other aspects like subversion, cyber warfare and electronic warfare are fast replacing firepower in achieving battlefield outcomes. With the end of New START,²¹ there is a revived interest in the development of missile defences. This is evidenced by the launch of programmes like the Golden Dome²² and Sudarshan Chakra. With the country leaders displaying ownership of such projects, there is focus and large-scale funding. It is only a matter of time when hypersonic weapons lose their current technical edge as well. Thus, hypersonic weapons, though possibly unstoppable at the moment, are fast headed towards a place in history.

NOTES

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