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Hypersonic Weapon of the Dragon : Implications for India



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“When entering a duel with a Lance wielding warrior..... No matter how strong your shield is, it’s wise to carry a Lance too”.

—Author

Introduction

Hypersonic Weapon Systems (HWS) has been a buzzword across the globe for since the past 04-05 years. However, they gained sudden prominence when the Russians used them on 15 March 2022 during the ongoing Ukraine conflict.¹ There are also reports of Chinese HWS being deployed along the Taiwan Straits. HWS are considered game changing missile systems as they can maximise the combination of speed, accuracy, manoeuvrability, range and payload simultaneously with no known defence against them. Individually, these capabilities can be achieved by the existing ballistic and cruise

Key Points

- Despite current arms control/proliferation control treaties, a ‘silent Hypersonic Arms Race’ is on amongst major military powers.
- Russia has taken lead in operationalising hypersonic weapons; it has also become the first country to use them in battle during the ongoing conflict with Ukraine.
- China has the fastest expanding hypersonic arsenal and is poised to replace upto 50 percent of its short and medium range missiles with DF-17 HGV in next five years.
- India has to factor in the emerging hypersonic weapon threats and embark on its own capability building, to counter these threats.

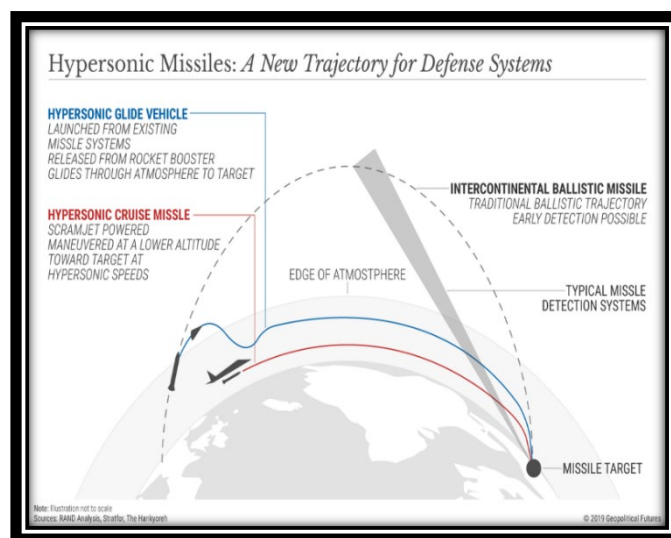
missiles. It is still a developing technology with an evolving employment philosophy. Nevertheless, there is a need for thorough analysis the HWS that China possesses and analyse its security implications for India.

What Are Hypersonic Weapons

Any projectile travelling at speeds over five times the speed of sound (>05 Mach) is said to be travelling at hypersonic speed. The missile systems capable of sustained endo-atmospheric (below 100 Km altitude) flight at hypersonic speeds with manoeuvrable flight path are called hypersonic weapons. In this regard, it must be noted that traditional ballistic missiles also travel at hypersonic speeds, however a significant part of their flight is exo-atmospheric (over 100 Km altitude) and they follow a pre-planned predictable parabolic flight path, hence these are not considered as Hypersonic weapons. There are primarily two types of hypersonic weapon systems—Hypersonic Cruise Missile (HCM) and Hypersonic Glide Vehicle (HGV).

- **Hypersonic Cruise Missile (HCM).** An HCM is simply a cruise missile which flies at hypersonic speeds. They are powered by scramjet engines, but due to high rate of fuel consumption and severe weight to force restrictions, their engine burn time is very short—the maximum successful reported burn of a scramjet is approx. four minutes, hence the range of hypersonic cruise missiles are restricted and they are not likely to attain inter-continental range (above 5,000 Kms) in near future; examples being, the Chinese DF-100 which is reported to have maximum flight range of 2,000 km.²

Figure 1: Flight Path comparison: HWS & ICBMs



Source: Government Accountability Office Analysis GAO-21-378



- **Hypersonic Glide Vehicle (HGV).** The HGV works on a 'boost-glide technology' with unpowered manoeuvrable glide flight, after being launched by a rocket booster in a sub-orbital trajectory. Since it derives its speed entirely from the initial thrust of the ballistic missile and earth's gravitational pull as it glides towards the target, therefore, its range is limited by that of the booster. Accordingly, the Chinese DF-17 systems which has an HGV (DF-ZF) mounted atop a DF-16 Ballistic Missile, has a maximum range of 1,500 kms only.³

Key Takeaways: HWS Technology

The HWS technology has been hailed as 'game changing weapons' of future, however, through a careful study of their key characteristics, following inferences could be drawn:

- At the core level, HWS are guided kinetic projectiles, which are only capable of delivering munitions at the intended targets.
- Due to their high speed, unpredictable flight paths and inflight manoeuvrability, HWS are difficult to interdict by known BMD system. Hence, they have a high mission success rate as compared to traditional ballistic / cruise missiles.
- HWS have the capability of carrying nuclear as well as conventional warheads, hence they could be inducted in a country's conventional as well as strategic forces.
- Ranges of known HGVs and HCMs are limited (1,000-2,000 kms) with unsubstantiated precision claims. However, countries like China are making efforts to overcome these limitations by developing 'ICBM mounted HGVs' and 'space launched HGV'.⁴

Hypersonic Weapons: Chinese Instruments for Strategic Signalling

China has introduced HWS into PLA Rocket Force (PLARF) inventory and considers it to be its 'Core Deterrence Power'. However, China seems to be developing and maturing HWS mainly for 'posturing rather than war-fighting', since it seeks to establish a nuclear deterrence parity with USA and simultaneously strengthen its Anti-Access Area Denial capability in the Indo-Pacific. China appears to be adopting a 'two pronged strategy' for 'development' and 'deployment' of HWS as described below:

- **Achieve Nuclear Deterrence Against USA.** China seeks to develop an assured second strike capability against counter-value targets on USA through HGVs. In this regard, the inter-continental range / space launched nuclear tipped HGV, with their High Mission Success rate, would ameliorate Chinese concern focusing mainly on the viability of their nuclear deterrence vis-à-vis USA. Hence, it makes sense for China to invest heavily into the unlimited range of Fractional Orbital Bombardment System Programme and ICBM mounted HGVs.

- **Strengthen Regional Nuclear Deterrence.** China is currently involved in territorial disputes in the East & South China Seas and it seeks to factor in such potential regional flashpoints into its military planning. Hence, China will have to develop forces to help assert its territorial claims and confuse US efforts to intervene in the region. Russia and India's nuclear forces as well as the potential of a nuclear Japan or South Korea in future, will also have to be factored into China's nuclear deterrence calculus. Hence, China is likely to develop a small nuclear HWS force in medium / intermediate ranges for regional deterrence.

Figure 2: DF-17-Medium Range HGV



Source: CSIS Missile Threat Project: 'Missiles of The World-China-DF17'

Nuclear HWS

- **Inadequacy: Current Nuclear Deterrence.** The PLARF maintains over 100 nuclear tipped ICBMs (DF-31 & DF-41).⁵ However, as compared to US capability of target acquisition and long range precision strikes, the land based Chinese missiles are vulnerable to a surprise first strike attack by USA. Subsequently, the surviving small number of Chinese ICBMs, if launched for a retaliatory strike, could easily be shot down in flight by US ship based 'Aegis' BMD system and land based Terminal High Altitude Air Defence (THAAD) system. Hence, some Chinese strategists consider their nuclear deterrence inadequate to deter USA which maintains a 'First Strike Policy' for nuclear weapons.

Figure 3: DF-41 ICBM



Source: CSIS Missile Threat Project-‘Missiles of The World-China-DF41

- **Likely Operational Philosophy.** China maintains a nuclear policy of “No First Use” (NFU) and “Credible Minimum Deterrence” (CMD). This had so far necessitated maintenance of a small nuclear arsenal and a lean missile force capable of surviving a first strike and retaliating against counter value targets on mainland USA. However, as China increasingly seeks the world power status, its professed need for nuclear deterrence for ‘preservation of sovereignty’ has transformed into an ambition of ‘nuclear deterrence parity’ with USA.⁶ To this extent, HWS has emerged as important force multipliers for Chinese Strategic Forces.

Conventionally Armed HWS

- **Likely Operational Philosophy.** As PLARF seeks to develop dual operational capability, therefore it plans to deploy a combination of conventionally tipped HWS along with nuclear tipped missiles. PLA specifies that, its conventional missile force is to be used against ‘high threat’ and ‘high value’ enemy targets, such as air and missile bases, recce & intelligence elements, C2 Centres, EW, Air Defence and logistics system.
- **Strengthen Anti-Access Area Denial Posture.** PLARF is responsible for conducting medium and intermediate range precision strikes against ‘key strategic and operational targets. In this regard, the conventionally tipped medium and intermediate range HWS with their extremely short flight time and precision strike capability, would strengthen the Chinese Anti-Access Area Denial posture in the South China Sea. The high precision Chinese HWS in medium range are likely to be used in Anti-Aircraft Carrier role against US intervention. In addition, mixes of

traditional ballistic missiles and HWS in intermediate and medium ranges are likely to be used to target US Air Force bases in the Western Pacific.

- **Utility: Taiwan Contingency.** Apart from the threat of US intervention in the South China Sea, developments in its immediate neighbourhood will also influence the trajectory of HWS induction in PLARF inventory. Currently, China's force structure is oriented towards 'Taiwan contingency'. Beijing still fears Taiwanese resolve to oppose integration and hence strives to maximise related deterrent and coercive capability. In this regard, the conventionally tipped medium range HGVs will provide a credible warfighting capability to Chinese Forces.

Likely Development: China's Conventional HWS

- **Likely Immediate Development.** In next –02-03 years, PLARF is likely to replace some of its DF-11 & DF-16 SRBM systems with new age spectacular DF-17 (HGV) and the DF-21 missiles. These are likely to be primarily deployed along the Taiwan Strait, however with a time penalty; their mobile launchers can also be deployed against India.
- **Likely Mid Term Development.** China is likely to develop scramjet powered HCM in medium ranges and deploy it in Anti-Ship role along with the DF-26B Intermediate Range Anti-Ship Ballistic Missile. This would enhance their A2AD posture in South China Sea and act as deterrence against US intervention in the region.

Figure 4: DF-26 Intermediate Range Ballistic Missile



Source: CSIS Missile Threat Project: 'Missiles of The World-China-DF26

- **Likely Long Term Development.** China is likely to arm its ICBM (DF-31 and 41) with MIRVed HGV warheads, and also develop a viable Fractional Orbital Bombardment System (FOBS) capability to threaten US.

Hypersonic Weapons and India

Weapons cannot be separated from the geopolitical context and for India. HWS can be significant tools for signalling and displaying its intent in the nuclearised neighbourhood. Hence, India must focus on a full-fledged development of its hypersonic capability as it provides an opportunity to guard its strategic interests. However, it is prudent to study the strategic objectives that HWS can serve and how these weapons may affect deterrence stability. It also has to be carefully examined as to whether or not the introduction of HWS is likely to reduce the relevance of existing ballistic and cruise missiles.

- **HWS for Strategic Deterrence.** India seeks to maintain an overall ‘dissuasive deterrence’ vis-a-vis China, and develop its military capability across spectrum to inflict great costs on it in case of a military misadventure. On the other hand, to effectively deter Pakistan, there is a need to adopt a ‘punitive deterrence’ strategy and display resolve to undertake surgical punitive actions at appropriate level and to also strengthen the assured second strike capability. HWS could become India’s game-changing capability as far as establishment of a ‘dissuasive deterrence’ against China and ‘punitive deterrence’ against Pakistan is concerned.
- **Utility: HGV and HCM.** The cruise missiles can be placed at lower rungs of nuclear escalation ladder as compared to ballistic missiles and are pre-dominantly ‘conventionally tipped’. India too deploys conventionally tipped Brahmos missiles during warfighting while segregating its ballistic missile arsenal for nuclear warheads. In the near future, India may revisit this stance, however under present circumstances, utility of HCMs and HGVs for the Indian Armed Forces is undeniable.

Defence Against HWS

- **Initiate: R&D on Active Countermeasures.** With the development and maturing of HWS, both electronic and kinetic counter-measures need to be explored. According to many claims and reports, the best suitable and effective counter-measure against HWS is space based tracking, but there are gaps in space-based coverage and tracking. Besides, it may give rise to arms race in anti-satellite weapons as counter measures to take down such satellites. Nevertheless, India needs to have its own robust counter-measure infrastructure against HWS.
- **Adopt: Passive Counter Measures.** India’s key surveillance assets—the AD assets, airfields and weapon systems, faces the threat from the adversaries’ HWS, against which the existing countermeasures may not be very effective. Hence, in order to



ameliorate the threat from enemy HWS, passive counter measures may have to be adopted.

Hypersonic Options for India

- **Deterrence: Join HWS Haves Group.** Mitigation and regulation of HWS is gaining ground in mainstream international discourse. Various means are available including limiting their numbers and banning acquisition of HWS. Notwithstanding, the final construct of proliferation control measures dictates India to have a Hypersonic Weapon at the earliest to meet its security concerns and act as a deterrence to the adversaries.
- **Invest in Countermeasures.** Along with having hypersonic capability, there is a need for India to invest in active and passive countermeasures against HWS to secure own critical assets. The ground based phased array radars have limited effectiveness against HWS hence development of space based infra-red sensor satellite network is essential in order to build an effective defence mechanism against HWS.

End Notes

¹ Paul Kirby, "Russia claims first use of hypersonic Kinzhal missile in Ukraine", BBC News, 19 March 2022. Available at <https://www.bbc.com/news/world-europe-60806151>. Accessed on 01 May 2022.

² "Military and Security Developments Involving the People's Republic of China 2021", *US DoD Annual Report to Congress*, p. 61. Available at <https://media.defense.gov/2021/Nov/03/2002885874/-1/-1/0/2021-CMPR-FINAL.PDF>. Accessed on 10 May 2022.

³ Ibid, p.62.

⁴ *The Financial Times Report*, 16 October 2021. Available at <https://www.ft.com/content/ba0a3cde-719b-4040-93cb-a486e1f843fb>. Accessed on 10 May 2022.

⁵ N.2.

⁶ Author's own view.

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