UNIVERSITY OF COPENHAGEN
CENTRE FOR MILITARY STUDIES

Hypersonic Weapons
and International Law

Kevin Jon Heller · February 2026

Hypersonic Weapons
and International Law

This Background Paper is a part of the research-based services that the Centre for Military Studies provides for the Danish Ministry of Defence and the political parties behind the Danish Defence Agreement. The Background Paper provides a brief but comprehensive overview of hypersonic weapons, with a particular emphasis on their strategic implications, and their compatibility with international law.
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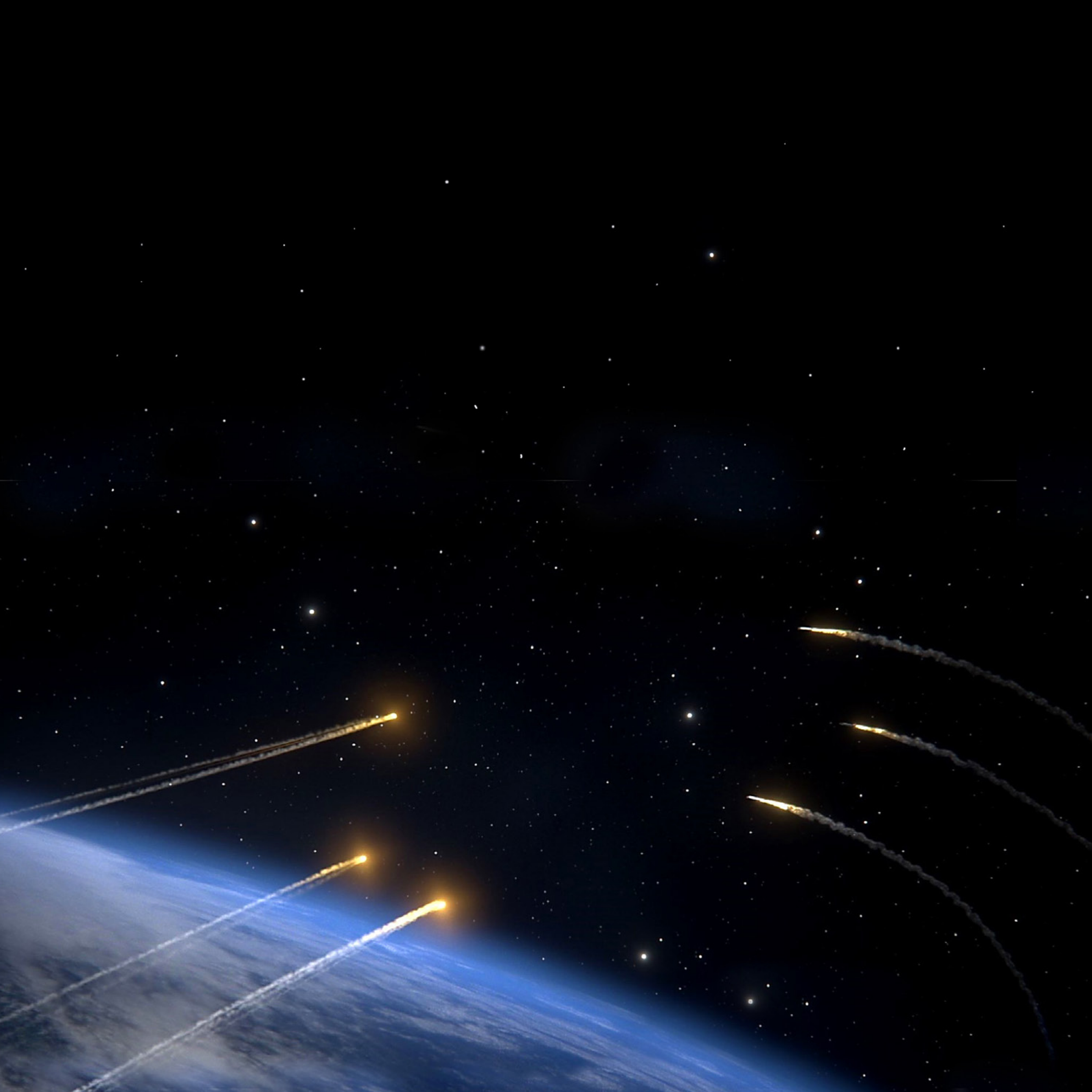

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I Introduction

On 18 March 2022, Russia used a Kh-47M2 Kinzhal hypersonic cruise missile (HCM) to destroy an underground arms depot in Western Ukraine. Although that attack marks the first known use of a hypersonic weapon in combat, many states now have active hypersonic programmes. China, considered the world leader in hypersonic technology, has almost certainly already deployed an intercontinental ballistic missile (ICBM) fitted with a hypersonic boost-glide vehicle (HGV). The US has yet to deploy a hypersonic weapon, but the Army, Navy, and Air Force are each developing HGVs. North Korea recently tested what is believed to be an HGV. And South Korea and Japan have active hypersonic development programs.

This Background Paper provides a brief but comprehensive overview of hypersonic weapons, with a particular emphasis on their strategic implications, their compatibility with international law, and potential methods for limiting their development, deployment, and use. Section II defines what makes a weapon hypersonic and explains the three basic types of hypersonic weapons. Section III discusses what kinds of hypersonic weapons states are currently developing. Section IV identifies the benefits of hypersonic weapons, while Section V explores to what extent states can defend against them. Section VI discusses the absence of effective arms control concerning hypersonic weapons. Section VII identifies various ways in which hypersonic weapons might create issues under the jus ad bellum and the jus in bello. And finally, Section VIII analyses various possibilities for regulating hypersonic weapons.

II Types of hypersonic weapons

Hypersonic weapons are commonly defined as weapons capable of speeds greater than Mach 5, five times the speed of sound. That definition, however, does not distinguish what are commonly considered hypersonic weapons from ballistic missiles or cruise missiles, both of which routinely exceed Mach 5. A better definition of a hypersonic weapon is thus the one provided by the Congressional Budget Office (CBO) in the United States: "[s]trictly speaking, it refers to a missile that travels at speeds at least five times the speed of sound in air (Mach 5 or above) and that spends most of its flight inside the Earth's atmosphere (rather than in space), where it can use aerodynamic design features to maneuver."[1] That definition distinguishes hypersonic weapons from ballistic missiles (by trajectory) and from non-hypersonic cruise missiles (by speed).

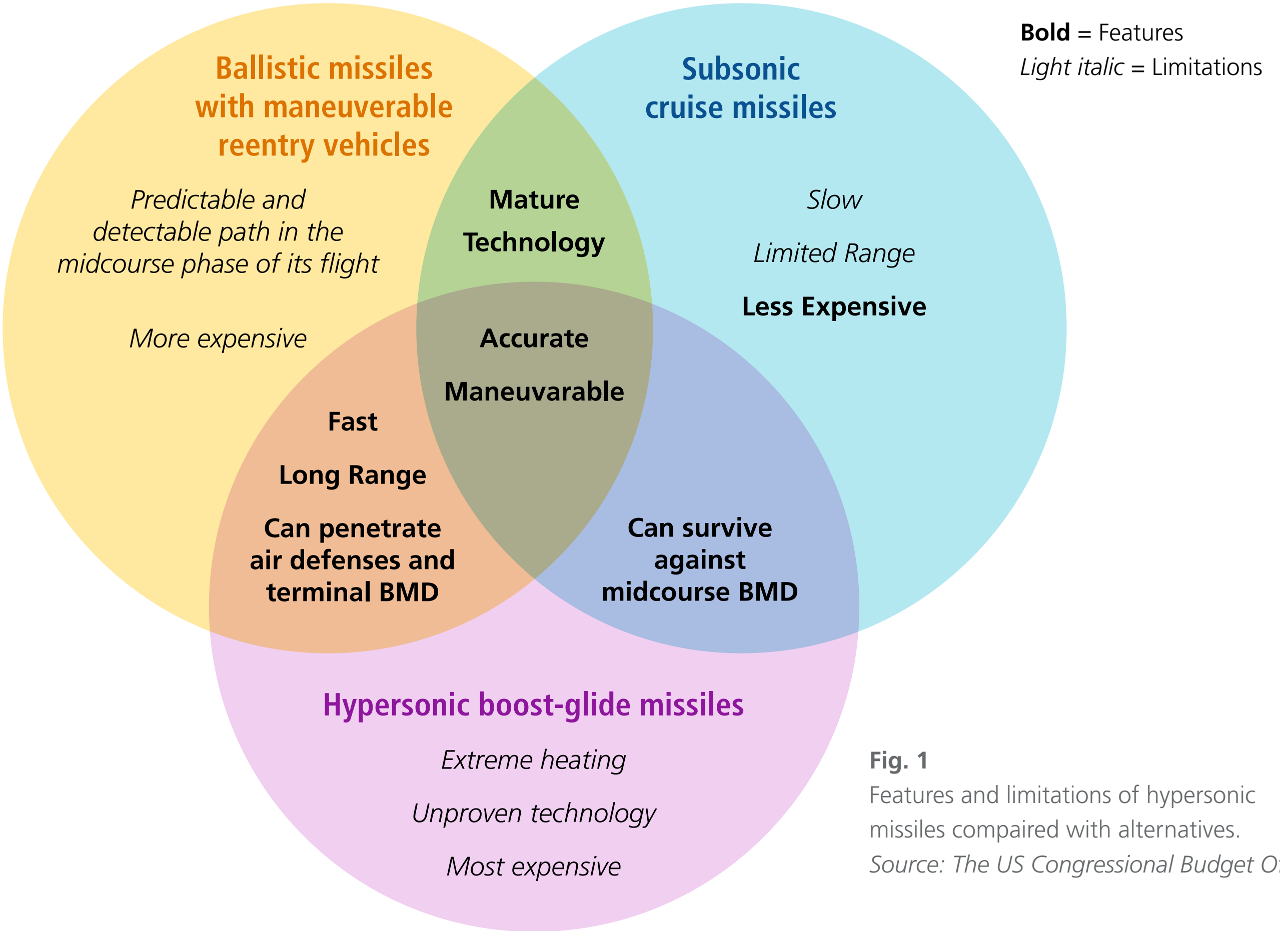


Fig. 1
Features and limitations of hypersonic missiles compaired with alternatives.
Source: The US Congressional Budget Office

States are currently developing three types of hypersonic weapons: "boost-glide," "air-breathing," and "gun-launched." A *hypersonic boost-glide missile* relies on a rocket to propel the weapon into a low-earth orbit. Once in orbit, the rocket travels until approximately 40-100 kms from the target, at which point the missile detaches, re-enters the atmosphere, and glides at hypersonic speeds atop the atmosphere until the target is reached.

Unlike HGVs, a *hypersonic cruise missile* (HCM) flies at an altitude between 20 and 30 kms and is powered during its entire flight. At first, HCMs are accelerated by a traditional mechanism, such as a rocket or launch vehicle. Once they reach Mach 5, however, propulsion is taken over by supersonic combustion ramjet engines – "scram-jets" – "that combust fuel within a stream of supersonic air passing through the vehicles."[2] That method of combustion means HCMs do not need to use motorized fan blades, making the system simpler and lighter than non-hypersonic missiles that rely on traditional jet engines and giving them greater thrust efficiency within the Earth's atmosphere.

Hypersonic gun-launched weapons are normally discussed separately from HGVs and HCMs, because their shorter range and speeds at the low end of the hypersonic spectrum make them more akin to enhanced artillery than to traditional missiles. The first type of gun-launched hypersonic weapon uses an electromagnetic pulse to fire a projectile along a launching rail. The second type is a "hypervelocity projectile," an artillery round that can be fired from a traditional powder gun, such as a 155-mm ground-based howitzer. Experts believe that gun-based hypersonic weapons will prove to be particularly valuable for defensive purposes, because they are cheaper and more tactically flexible than traditional missile-defence systems.

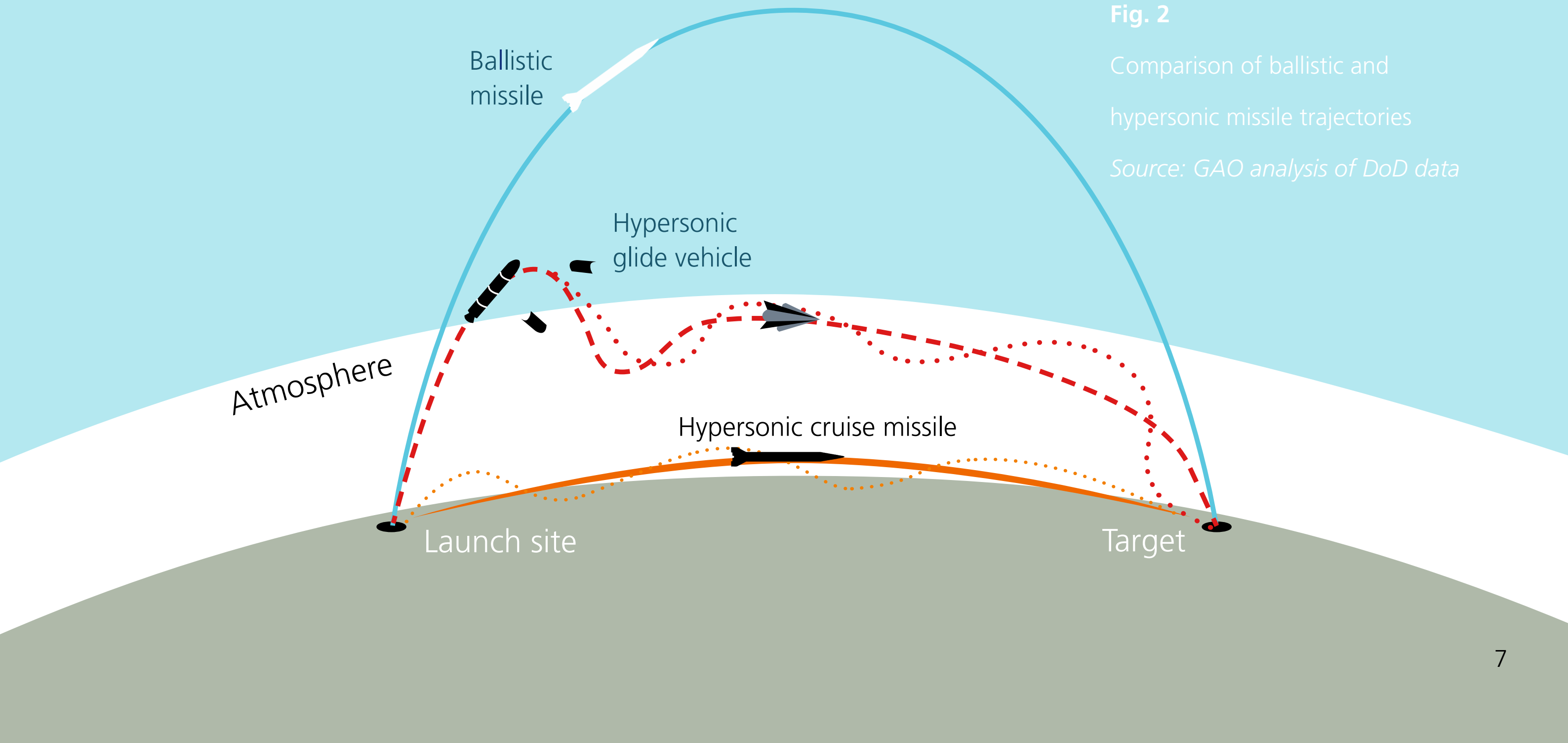


Fig. 2

Comparison of ballistic and hypersonic missile trajectories

Source: GAO analysis of DoD data

III Hypersonic capabilities

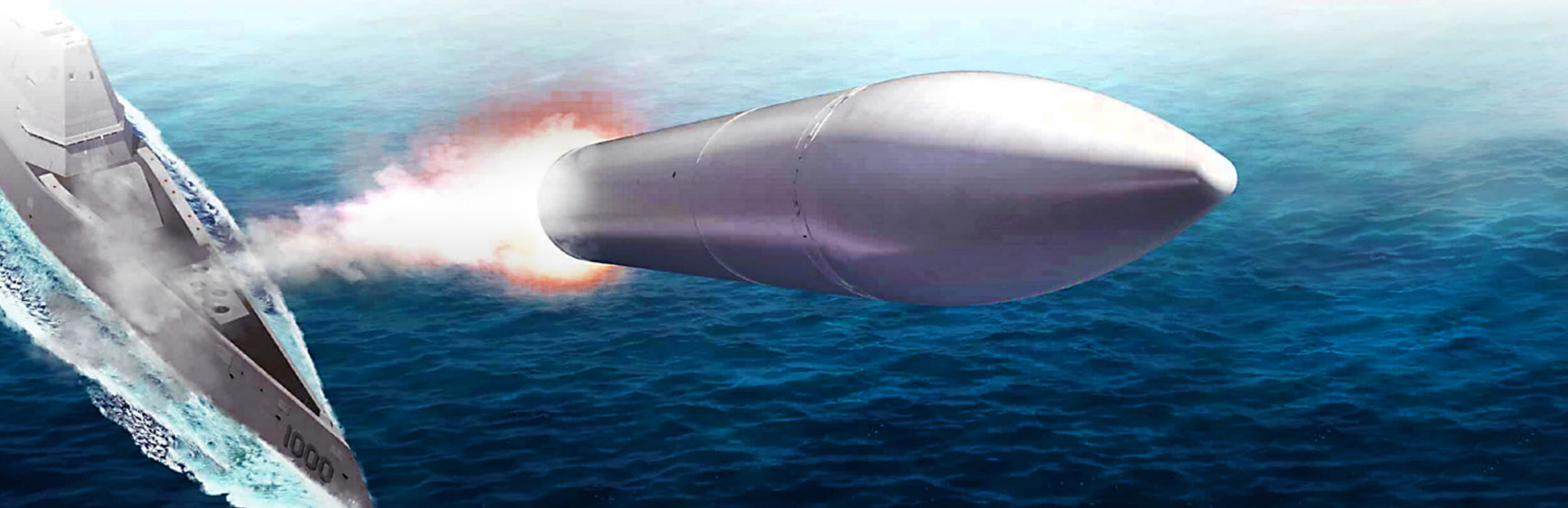
Development of hypersonic weapons is being driven by the three usual suspects: **the United States, Russia,** and **China.**

UNITED STATES

The US has been developing hypersonic weapons since the early 2000s as part of its Conventional Prompt Global Strike (CPGS) program. CPGS seeks "to provide the United States with the ability to strike targets anywhere on Earth with conventional weapons in as little as an hour, without relying on forward-based forces."[3] US interest in hypersonic weapons has increased rapidly over the past few years in response to Russia and China pulling significantly ahead in the hypersonic race, because their lead threatens to enable China and Russia "to overpower US allies and seize their territory while holding off US and other allied combat power" until they extend their A2/AD and defensive umbrella.[4] In the US's view, responding to that threat requires deploying a variety of hypersonic weapons that do not have to be based on the territory of other states.

The Army, Navy, and Air Force are each developing HGVs, and the Air Force is developing an HCM. In terms of HGVs, the Army and Navy are collaborating on a glide body – the Common Hypersonic Glide Body – that they will use in different missile systems. The Army's HGV, the *Long-Range Hypersonic Weapon* (LRHW), nicknamed the "Dark Eagle," has a range exceeding 2,775 kms and is designed to be a ground-based system launched by mobile transporter-erector-launcher (TEL) vehicles. The first battery is scheduled to be deployed in 2026. The Navy's HGV, called the *Intermediate-Range Conventional Prompt Strike* (IR-CP), will be launched at sea and is expected to have a maximum range similar to the LRHW. The Navy intends to conduct its first at-sea launch in 2027 and have full operational capability by 2029.

The Air Force's HGV, whose deployment date is unknown, is based on the Tactical Boost Glide (TBG) vehicle developed by DARPA. Called the *AGM-183A Air-Launched Rapid Response Weapon* (ARRW), the missile is intended to be launched from the air by B-52 bombers and perhaps even the B-1. The range of the ARRW will be at least 900 kms. The Air Force almost cancelled the ARRW in 2023 because of testing failures but is seeking funds in the fiscal 2026 budget to revive the programme. The Air Force is also working with DARPA to develop the *Hypersonic Attack Cruise Missile* (HACM), with reports indicating that HACMs are intended to be launched from both bombers and fighter planes.



RUSSIA

Russia’s interest in hypersonic weapons is driven by fear of US advances in offensive and defensive missile technology, which it believes might enable the US to launch a successful first strike with conventional missiles and then neutralise a weakened Russian response. Russia thus views hypersonic weapons as a critical means to increase its second-strike capability, maintaining nuclear deterrence with the US via mutually assured destruction.

Russia has deployed two hypersonic weapons – the Avangard and the 3M22 Tsirkon – and used two more, the Kh-47M2 Kinzhal and the Oreshnik. The *Avangard* is an HGV launched from an ICBM, giving it essentially unlimited range. The Avangard can reportedly reach speeds up to Mach 20 and features both countermeasures and maneuverability.

The *Tsirkon* is a ship-launched HCM that can travel between Mach 7 and Mach 8 with a maximum range of 1,000 kms. It can be fired using the vertical launch systems mounted on various Russian ships and submarines and can strike either ground or naval targets. The Tsirkon HCM is currently deployed on the Russian Navy’s first Project 22350 frigate, the Admiral Gorshkov.

The *Kinzhal* is an air-launched hypersonic ballistic missile that is an upgraded version of Russia’s ballistic 9M723 Iskander missile. The Kinzhal can strike both ground and naval targets and supposedly has a top speed of Mach 10 and a maximum range of 3,000 kms. Ukraine has been able to successfully intercept several Kinzhals, calling their maneuverability into question, but the missile should still be of particular concern to Denmark because Russia intends to deploy it in the Arctic with the Northern Fleet. Russia will also likely use Kinzhals to replace or supplement its Iskander brigade near the Norwegian border. Such deployment would greatly enhance Russia’s offensive potential in Scandinavia, because the Kinzhal’s operating range is nearly six times the operating range of the Iskander. That means the Kinzhal would have the ability to strike most of Northern Europe, whereas the Iskander’s 500 km range cannot even reach NATO’s military sites in Bodø.

The Tsirkon

The *Oreshnik* is an intermediate-range ballistic missile that can travel at speeds exceeding Mach 10 and has a maximum range of 5,500 kms. It is equipped with six warheads in a MIRV (multiple independently targetable re-entry vehicle) configuration, and there are suggestions that the warheads may themselves be HGVs instead of traditional warheads, which would allow them to manoeuvre during descent. Russia fired an Oreshnik at Dnipro as an ”experiment” in November 2024, injuring three Ukrainians and damaging buildings. Putin has said that the Oreshnik will be deployed at various locations in Belarus by the end of 2025.

The Xingkong-2

CHINA

China's interest in hypersonic weapons also stems from concerns about the US's missile capability. First, like Russia, China fears the possibility of the US conducting a successful pre-emptive strike on its nuclear arsenal and then using advanced missile defences to limit the effects of a retaliatory Chinese strike. In fact, China is even more concerned about US missiles than Russia, because its nuclear arsenal is considerably smaller, limiting its second-strike capability. Second, China is concerned that US missile capabilities in the Asia-Pacific threaten its hegemony over Taiwan and in the South China Sea. Hypersonic weapons are viewed by China as a solution to both problems.

China currently possesses two hypersonic weapons. The first, which has been deployed since 2020, is the *DF-ZF* HGV. The DF-ZF, which was previously known as the Wu-14, will primarily be deployed on the DF-17 medium-range ballistic missile, which has been specifically designed to carry hypersonic weapons. It is reportedly extremely maneuverable with a range of 1,800 to 2,500 kms and a top speed of Mach 10.

The second hypersonic weapon is *Xingkong-2*, an HCM equipped with a scramjet engine. China claims that, in tests, the Xingkong-2 reached Mach 6 and was able to execute several maneuvers before landing. The missile, which is designed to be nuclear capable, was scheduled to be operational by the end of 2025 but has not been deployed as of this writing.

South Korea's Hycore Hypersonic Cruise Missile

OTHER COUNTRIES

North Korea claims to have successfully tested three HGVs designed to be fired from mobile road-based launchers: the *Hwasong-8*, which supposedly has a top speed greater than Mach 5 and a maximum range of 4,000 kms; the ostensibly more advanced *Hwasong-16*; and the *Hwasong-11a*. South Korea is developing a ground-launched HCM, the *Hycore*, that can reach speeds greater than Mach 6. It is slated for deployment in the mid-2020s. And Japan is developing two hypersonic weapons: the *Hypersonic Cruise Missile* (HCM) and the *Hyper Velocity Gliding Projectile* (HVGP). Japan supposedly intends to use HVGPs, which are scheduled to be deployed in 2026, against aircraft carriers and for area suppression. The HCM will not enter service until at least 2030.

The Hwasongpho-16B on its TEL (with the clamshell at the front open)

IV Advantages of hypersonic weapons

Reflecting their design, hypersonic boost-glide vehicles and hypersonic cruise missiles have three distinct benefits: speed, altitude, and maneuverability.

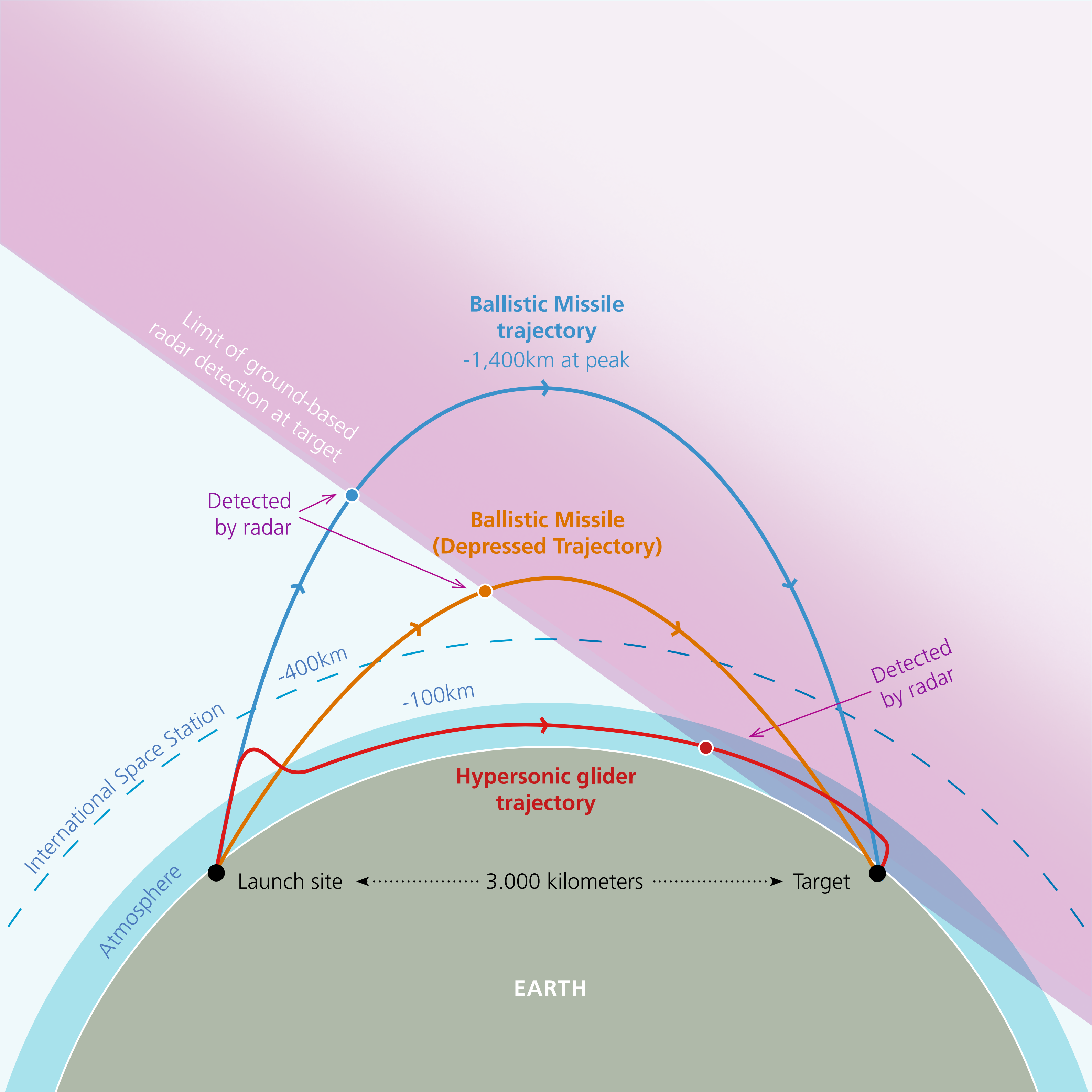
Missiles that travel at speeds greater than Mach 5 have several advantages over slower weapons, such as subsonic cruise missiles. First, they reach their target much more quickly, reducing the attacked state's reaction time. For example, HGVs and HCMs will reach targets less than 2,000 kms away 9-11 times faster than subsonic cruise missiles.[5] Second, the faster a missile travels, the more difficult it is to intercept. And third, the significant kinetic energy created by traveling at Mach 5+ means that many hypersonic missiles will not need an explosive warhead to destroy their target.

Both HGVs and HCMs also benefit from the altitudes at which they fly. HGVs travel at a lower altitude than either ballistic missiles on a minimum-energy trajectory or ballistic missiles on a depressed trajectory. On longer flights that means they will be undetectable by radar located at the target for far longer, making them more difficult to intercept. Similarly, many countries use ground-based radars that are not equipped to defend against HCMs because they travel below the altitude of ballistic missiles but above the altitude of surface-to-air missiles such as the Patriot. At short distances, such HCMs are almost impossible to intercept.

Finally, the maneuverability of HGVs gives them an advantage over traditional ballistic missiles. Apart from a small number of re-entry vehicles, most ballistic missiles cannot maneuver. The predictable flight path of non-maneuverable ballistic missiles makes them relatively vulnerable to midcourse ballistic missile-defense systems, which are able to calculate precisely where the missile will be when an interceptor is able to reach it. Interception is considerably more difficult for an HGV because it can change its path at any time.

These advantages, of course, do not exist in isolation. What makes hypersonic weapons so valuable is that they combine advantages. HGVs are not faster than traditional ballistic missiles, but they travel at lower altitudes and have unpredictable flight paths because of their maneuverability. HCMs are not more maneuverable than subsonic cruise missiles, but they are much faster and fly at an unusual altitude.[6]

Fig. 3 *Ground-based radar detection of ballistic missiles vs. hypersonic glide vehicles*
Based on original illustrations from The Economist and the US Congressional Budget Office


Ballistic Missile
trajectory
-1,400km at peak
Limit of ground-based
radar detection at target
Detected
by radar
Ballistic Missile
(Depressed Trajectory)
-400km
-100km
International Space Station
Detected
by radar
Hypersonic glider
trajectory
Atmosphere
Launch site
3.000 kilometers
Target
EARTH

V Defence against hypersonic weapons

Intercepting a hypersonic weapon is most likely to succeed during its initial launch and boost phase, before an HGV has left the Earth's atmosphere or an HCM has reached top speed. For example, the sensors on an F-35 could potentially detect the infrared signature of a hypersonic being launched in time to intercept it. It is also possible that some currently existing missile-defence systems, particularly the Terminal High-Altitude Area Defense (THAAD), could be adapted to reliably neutralize a hypersonic attack during its slower terminal phase. Only the richest states, however, will be able to deploy the number of systems required to deal with the multiple attack vectors of maneuverable hypersonic weapons.

States are currently developing new ways to defend against HGVs. The US is working on directed-energy weapons that have the potential to destroy an HGV during its launch and boost phase, but it is unknown when such technology might be ready for deployment. DARPA and the US Missile Defense Agency are also in the early stages of developing missile-defence systems that could target HGVs while they are traveling in the upper atmosphere. The latter would involve pairing a new "Glide Phase Interceptor" missile with the Aegis ballistic missile-defence system.

None of these systems would be capable of providing an effective defence against HCMs (much less hypersonic rail guns), because they are smaller and remain in the atmosphere during flight. It is possible that some of the systems currently used to defend against supersonic cruise missiles, such as the Evolved SeaSparrow Missile, could be enhanced to respond more quickly, but the technology remains unproven. The US Missile Defense Agency is also currently working to deploy a constellation of low-orbit surveillance satellites that would greatly enhance the ability of the US and its allies to detect the launch of HCMs, making them easier to intercept with upgraded missile-defence systems.

A RIM-7 Seasparrow missile is fired from the trainable Mk 29 launcher

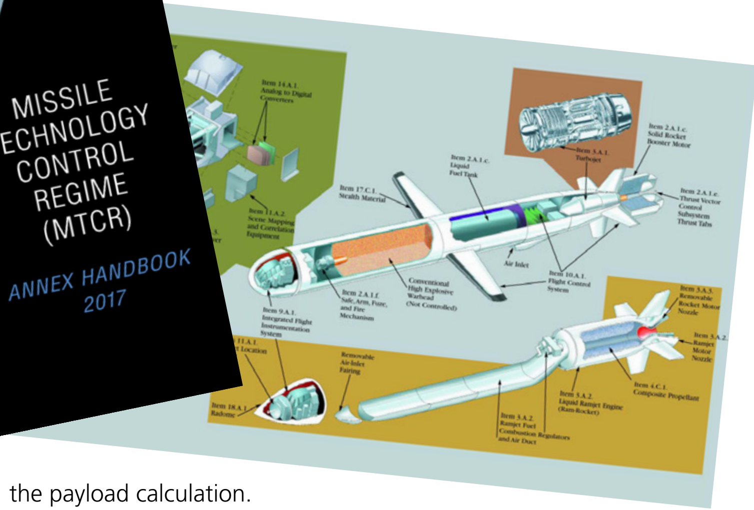
President Barack Obama and President Dmitry Medvedev meet in London in 2009 to announce their pursuit of the New START Treaty

VI Status under arms control

The US, Russia, and China have shown little interest in using bilateral or multilateral treaties to regulate, much less prohibit, the development and use of hypersonic weapons.

One reason the US became interested in developing hypersonic weapons is that the Department of Defense believed they were not prohibited by the *Intermediate-Range Nuclear Forces Treaty* (INF). The Treaty applied to any missile that either "has a ballistic trajectory" or "sustains flight through the use of aerodynamic lift" for "most of its flight path." HGVs skip in and out of the atmosphere, thus arguably not satisfying either limb of that test. The question is now moot, because the US formally withdrew from the INF Treaty in late 2019.

A similar problem affects the *New START Treaty*, which limits Russia and the US to 700 deployed ICBMs, deployed submarine-launched ballistic missiles, and deployed heavy bombers equipped for nuclear armaments. New START defines a rocket booster as "a weapon delivery vehicle that has a ballistic trajectory over most of its flight path." The US position is that New START does not apply to HGVs



because they do not qualify as rocket boosters under that definition. Russia has publicly taken the same view. Regardless of whether that is correct, Russia announced in February 2023 that it was suspending its participation in New START and likely intends to withdraw from the treaty.

Given the absence of applicable arms-control treaties, only soft sources of international law exist to regulate hypersonic weapons. One of the most important is the *Missile Technology Control Regime* (MTCR), which is intended to limit the export of ballistic missiles and other kinds of uncrewed delivery vehicles capable of carrying weapons of mass destruction. 35 states participate in the MCTR, including the US and Russia but excluding China. Participation in the regime is voluntary.

The MTCR divides technology into two categories. Category I covers systems capable of delivering a payload of at least 500 kg to a range of at least 300 km. The regime subjects Category I exports to a strong presumption of denial, regardless of the reason for export. Category II covers systems capable of delivering smaller payloads at least 300 kms and requires states to take non-proliferation considerations into account before exporting them. It is unclear whether hypersonic weapons fall into Category I or Category II. The MTCR Annex Handbook 2017 mentions HGVs as a potential type of Manoeuvring Re-entry Vehicle controlled under Category I. But many HGVs (as well as many HCMs) may fall into Category II either because their conventional payload is below the 500 kg limit or because they rely on kinetic energy alone, which is excluded from the payload calculation.

Another relevant soft-law instrument is the *Hague Code of Conduct against Ballistic Missile Proliferation* (HCoC). HCoC is a politically binding commitment by states to exercise maximum restraint in and engage in transparency measures toward the development, testing, and deployment of ballistic missiles. 143 states subscribe to HCoC, again including the US and Russia but excluding China. The ICBM boosters used in HGVs would be subject to the commitments in HCoC.

The final relevant soft-law instrument is the *Wassenaar Arrangement*, which is intended to promote transparency, consultation, and restraint concerning the transfer of conventional arms and dual-use goods and technologies. The 42 participating states – which yet again include the US and Russia but exclude China – are supposed to apply export controls to items in the Arrangement's various control lists. Ballistic missile systems are included in the dual-use list, while re-entry vehicles are included in the munitions list. HGVs might qualify as "high velocity kinetic energy weapon systems" covered by the Arrangement's munitions list, although that category was created with rail gun technology in mind.

VII Jus ad bellum and jus in bello effects

The advantages of hypersonic weapons create compliance issues under both **the rules governing the use of inter-state force *(the jus ad bellum)*** and **the rules governing the conduct of hostilities *(the jus in bello)*.**

JUS AD BELLUM

Art. 51 of the UN Charter provides that "[n]othing in the present Charter shall impair the inherent right of individual or collective self-defence if an armed attack occurs against a Member of the United Nations." Although the text of Art. 51 requires an armed attack to be occurring, most states accept that the right of self-defence also applies to attacks that have not yet begun but are imminent, with an imminent attack understood as one "leaving no choice of means and no moment for deliberation."

Since 9/11, however, a small number of powerful states – particularly the US, UK, and Australia – have insisted that the traditional definition of imminence prevents them from effectively defending themselves against armed attacks using modern weaponry. Those states claim that imminence must be understood more flexibly, asking not whether an attack is about to occur, but whether the threatened state is about to lose its "last clear opportunity" to act in self-defence.[7] In their view, if the window of opportunity to negate a threat is about to close, states have a right to act in self-defence even if the armed attack has not yet begun to commence.

The speed of hypersonic weapons will almost certainly encourage more states to adopt a definition of imminence that is broader than the traditional standard. If states cannot reliably intercept an HGV or HCM once it is in the air, they will not wait until launch to destroy it. Instead, they

will attack the launcher – a bomber, a ship, a ground battery – as soon as they are convinced launch will inevitably occur, even when that means using force long before the "attacker" has the ability to actually fire the hypersonic weapon. The possibility of erroneously assessing a state's intentions in such a situation is evident.[8]

The pressure that speed will put on the traditional understanding of imminence will be further exacerbated by the ability of HGVs and HCMs to carry either a nuclear or conventional payload. If a state fearing attack by an HGV or HCM does not know what kind of payload it is carrying, it may err on the side of caution and destroy the HGV of HCM long before the attack can plausibly be said to be imminent. Such pre-emptive self-defence is almost universally condemned by states, but that may well change if hypersonic weapons create too much nuclear ambiguity.

The increased maneuverability of hypersonic weapons relative to their non-hypersonic counterparts is also likely to put pressure on the jus ad bellum, because states will find it much more difficult to identify an HGV's or HCM's target. A state that detects the launch of a hypersonic weapon capable of reaching its territory may not wait until it becomes clear whether it is, in fact, being targeted – particularly if nuclear ambiguity is an issue. Erroneously destroying (or attempting to destroy) an HGV or HCM would, however, violate the prohibition of the use of force in Art. 2(4) of the UN Charter, because a state cannot act in self-defence unless it is the target of an armed attack. Even worse, destroying a hypersonic weapon in such a situation would itself be an armed attack on the state that launched it – giving that state the right to respond with force in self-defence. Such "misunderstandings" could all to easily give rise to interstate conflicts that quickly spiral out of control.

JUS IN BELLO

Like all weapons, hypersonic weapons must be used in a way that complies with the basic rules of international humanitarian law (IHL). The key issue with HGVs and HCMs is their accuracy. Hypersonic weapons will be considerably more accurate than ICBMs[9] due to their superior maneuverability. But it is highly unlikely that they will be as accurate as subsonic cruise missiles.[10] Missile accuracy is a function of two factors: guidance (knowing how to reach the target), and control (the ability to execute the guidance). Because hypersonic weapons travel much faster and at a much higher altitude than subsonic cruise missiles, both their guidance and their control will be more negatively affected by externalities such as gravity, unpredictable winds, variations in air density, and heat caused by traveling through dense air.

That decreased accuracy will not raise significant IHL issues when hypersonic weapons are used against ships or aircraft, where civilians and civilian objects are unlikely to be harmed by a missile that fails to strike its target. Land-based targets are a different story, when they are located near civilians and civilian objects. That will often be the case for traditional military objectives in urban warfare (particularly those that are dual use, such as bridges or electrical grids), and it will even more likely when the target is a non-state actor such as the leader of a terrorist group – the kind of "fleeting target," according to the CBO in the United States, for which hypersonic weapons are well-suited. In such a situation, employing a hypersonic weapon with a high enough CEP that it "cannot be directed at a specific military objective" would qualify as an indiscriminate attack under Article 51(4)(a) of Additional Protocol I and under customary international law.

YJ-20 hypersonic missiles on parade in Beijing, 2025

Turkeys Tayfun Block-4 hypersonic ballistic missile, on show at the IDEF 2025 in Istanbul

VIII Possibilities for regulation

Despite the military utility of hypersonic weapons, there are legitimate strategic and legal concerns about their development, proliferation, and use. The inability of states to effectively defend against hypersonic weapons, combined with the omnipresent threat of nuclear ambiguity, is highly likely to lead states to use force in ostensible self-defence much earlier than they would when faced with non-hypersonic threats. Such reactions threaten to destabilise not only the *jus ad bellum* but also international security more generally. Using arms control to regulate hypersonic weapons is thus in the interest of all states – particularly those like Denmark, whose territory and interests are well within reach of Russia's growing hypersonic arsenal.

A multilateral treaty that prohibited the development and use of hypersonic weapons would be the most effective form of arms control, but it is highly unlikely that any of the hypersonic-capable states would be willing to join such a treaty. A less ambitious multilateral treaty that would prohibit only particularly dangerous uses of hypersonic weapons, such as targeting nuclear weapons or military objectives located in dense urban areas, would be more palatable but would raise almost impossible verification issues. A third possibility would be to limit the proliferation of hypersonic weapons along the lines of the Nuclear Non-Proliferation Treaty – requiring hypersonic-capable states not to transfer their technology and non-hypersonic states to not seek such transfers or develop hypersonic weapons themselves. That kind of treaty would appeal to the hypersonic-capable states, given their evident interest in limiting the number of states that pose a hypersonic threat to them. But non-hypersonic states would be a more difficult sell, because hypersonic weapons are militarily useful in a way that nuclear weapons are not.

Given the small number of hypersonic-capable states, bilateral, trilateral, or plurilateral treaties would also be an option. One possibility would be to amend New START to cap the number of permissible strategic nuclear-capable hypersonic weapons. Another possibility would be to revive and expand the INF, although that would require Russia to address the non-compliance issues that led the US to withdraw from the treaty in the first place. A third possibility – and perhaps the most realistic – would be a trilateral or plurilateral non-proliferation treaty between hypersonic-capable states, which would not eliminate the possibility of non-hypersonic states developing them but would make it significantly more difficult for them to do so.

Because negotiating arms-control treaties is difficult even when states have similar interests, getting states to agree to politically binding forms of hypersonic arms control might be more promising. An excellent step would be for states to amend the MTCR to explicitly include HGVs and HCMs in Category I, thus establishing a strong presumption against their export. Amending the Wassenaar Arrangement in a similar fashion would also be useful – as would bringing hypersonic weapons within the HCoC regime, although some states might resist making even politically binding commitments not to develop such weapons.

Picture sources

Front cover: The test-fire of a new intermediate-range hypersonic ballistic missile at an undisclosed location in North Korea. January 6, 2025.
Photo: KCNA / UPI / Alamy

Page 3: Missile interception. *Illustration: LockheedMartin*

Page 5: A Kh-47M2 Kinzhal being carried by a Mikoyan MiG-31K interceptor. *Photo: Wikimedia*

Page 8: The Conventional Prompt Strike program to develop and test hypersonic boost-glide missiles.
Illustration: Lockheed Martin

Page 9: A graphic circulating on the internet purporting to show the Tsirkon. *Source: AINOnline*

Page 10: A reported sighting of the Xingkong-2, loaded into its rocket delivery vehicle.
Photo: Youtube (uploaded by SciNews)

Page 11: South Korea's Hycore Hypersonic Cruise Missile
Photo: Defence Securty Asia

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Photo: Korean Central News Agency

Page 14: A U.S. warship detecting threats, as part of the proposed Golden Dome defence project.
Illustration: LockheedMartin.

Page 15: A RIM-7 Seasparrow missile is fired from the trainable Mk 29 launcher. *Photo: U.S. Navy / Jordan Beesley*

Page 16: U.S. President Barack Obama and Russian President Dmitry Medvedev meet in London to announce their pursuit of the New START Treaty. April 1, 2009.
Photo: GM Current Affairs / Alamy

Page 17: The Missile Technology Control Regime - Annex Handbook

Page 18: YJ-20 hypersonic missiles on show at a military parade in Beijing. September 3, 2025.
Photo: Ethan Hunter / Nexpher Images / Alamy

Page 20: Turkish weapons manufacturer Rocketsan's Tayfun Block-4 hypersonic ballistic missile, displayed at the 2025 International Defence Industry Fair in Istanbul.
Photo: AA Photo

Back Cover: A 24-hour Yonhap news TV broadcast at Seoul Railway Station showing the North Korean launch of a hypersonic missile.
Photo: Kim Jae-Hwan / SOPA Images / Alamy

Notes

1 Congressional Budget Office, U.S. Hypersonic Weapons and Alternatives (2023): 1.
2 John T. Watts et al., Primer on Hypersonic Weapons in the Indo-Pacific Region (2020): 5.
3 Quoted in ibid., 12.
4 Elbridge A. Colby, Testimony Before the Senate Armed Services Committee: Hearing on Implementation of the National Defense Strategy, Senate Armed Services Committee (January 2019): 3–4.
5 Congressional Budget Office, 30.
6 Ibid., 31.
7 Attorney General of the United Kingdom, Speech at International Institute for Strategic Studies, The Modern Law of Self-Defence (11 January 2017): 16.
8 Terry D. Gill, The Jus Ad Bellum Anno 2040: An Essay on Possible Trends and Challenges, in Matthew Waxman, THE FUTURE LAW OF ARMED CONFLICT (OUP, 2022): 35.
9 The US Minuteman III has a circular error probable (CEP) of 120 m, while the Russian SS-19 has a CEP of 300 m.
10 The Chinese CJ-10, a land-attack missile, and the US Tomahawk each have CEPs of less than 10 m.


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