

U.S. Develops Countermeasure Capability Vs Hypersonic Weapons

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1. News Highlights

The development of hypersonic missiles in some countries has become an urgent threat. As China and Russia have begun to deploy such weapons while North Korea is also test-launching such missiles, they will pose a significant threat to the US and its allies.¹ With their high speed and unpredictable trajectory, hypersonic missiles pose a great challenge to the existing missile interception and detection systems. As a countermeasure, the US and its allies are developing warning systems and a new generation of intercepting weapons such as the

Glide Phase Interceptor (GPI) as well as related network and electronic warfare mechanisms.

2. Security Implications

“Hypersonic” refers to the flight in the atmosphere at a speed of Mach 5 or more.² The current development includes weapon-type missiles and drones as well as vehicles and aircraft capable of carrying personnel or equipment for specific missions. Hypersonic missiles are developed in two types: “hypersonic gliders” with a “wave-rider

1. “Defense Spending Act Makes Hypersonic A Top Priority, Calling For Billions In Investment,” *CNBC*, December 29, 2021, <https://www.cnbc.com/2021/12/29/defense-act-makes-hypersonic-top-priority-calls-for-investing-billions.html>.

2. Yasmin Tadjdeh, “SPECIAL REPORT: Defense Department Accelerates Hypersonic Weapons Development,” *National Defense Magazine*, July 11, 2019, <https://www.nationaldefensemagazine.org/articles/2019/7/11/defense-department-accelerates-hypersonic-weapons-development>.

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body” warhead lifted by rocket engines; they glide to hit the target. Meanwhile “hypersonic cruise missiles” are propelled by air-breathing ramjet engines. Since the speed of conventional ballistic missiles re-entering the atmosphere in parabolic trajectories can exceed Mach 8, they can be categorized as hypersonic as well. Because the trajectories of the new-generation hypersonic missiles cannot be predicted by calculation, it makes it tough to effectively intercept them currently. As a result, the 2022 US National Defense Authorization Act listed hypersonic research among other first-priority items to accelerate the development of various hypersonic weapons as well as methods to counter the missiles, such as the new GPI and space surveillance technologies.

2-1. Existing missile defense can't counter hypersonic weapons

The US Missile Defense Agency (MDA) is concerned that the current capability in detecting and intercepting hypersonic missiles in their glide phase is still inadequate. Since the

parabolic trajectories of conventional ballistic missiles are mostly in the outer atmosphere, they can be predicted by the geosynchronous satellites deployed in the Earth orbit. On the other hand, with shorter flight paths in space and can be further maneuvered, the altitude of hypersonic missiles is just outside the coverage of missile detection satellites and land-based long-range early warning radars. Although the existing US ship-based Aegis and X-band radars are capable of tracking hypersonic missiles, they must be deployed at the right locations to function; and neither the Navy Standard 3/Standard 6 missiles nor land-based THAAD (Terminal High Altitude Area Defense) systems have sufficient range to intercept hypersonic missiles, that's why the US is desperate to develop dedicated sensors and intercepting system.³

2-2. MDA develops GPI to intercept hypersonic weapons

On November 19, 2021, the MDA announced that it commissioned three companies, Lockheed Martin, Northrop

3. “Raytheon, Northrop, Lockheed to Compete For Hypersonic Interceptor,” *Breaking Defense*, November 19, 2021, <https://breakingdefense.com/2021/11/raytheon-northrop-lockheed-to-compete-for-hypersonic-interceptor/>.

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Grumman, and Raytheon, to develop a GPI dedicated to neutralizing hypersonic weapons in their gliding phase.⁴ The systems are scheduled to be tested in 2023.⁵ The new GPI must be suitable for deployment aboard current US Navy destroyers to be launched with a vertical launch system in collaboration with the existing SPY-1 “Baseline 9” radars capable of detecting, tracking, and engaging hypersonic weapons. All three companies have experience in the development of hypersonic weapons: Lockheed Martin developed the AGM-183A Air-launched Rapid Response Weapon (ARRW) for the Air Force and worked with the Defense Advanced Research Projects Agency (DARPA) on the Hypersonic Air-breathing Weapon Concept (HAWC). In addition, it’s the system integrator for the Navy’s Conventional Prompt Strike missile and the Army’s long-range hypersonic missile while competing with Raytheon

for the ramjet-propelled hypersonic missile program. Northrop Grumman is a developer of hypersonic vehicle thrusters.⁶

The MDA had stopped developing hypersonic missile defense capabilities in 2020 but restarted the program in 2021. In addition to evaluating the solutions currently under development, the agency is upgrading the ship-based Aegis phased-array radar with the capability to intercept hypersonic missiles at the final phase of their flight path, and the future SPY-6 radar will further improve the ability to track hypersonic missiles as well. The MDA believes that intercepting hypersonic missiles in their unpropelled glide phase will be most effective, but “hard kills” with kinetic energy or high explosive munitions are also under assessment.

The GPI paired with the ship-based Aegis system with missile defense capability will provide an additional layer of defense against hypersonic missiles to expand the defense capability of Aegis.

4. See Note 2.

5. “MDA: Hypersonic Missile Tracking Prototypes On Point For 2023 Launch,” *Breaking Defense*, November 11, 2021, <https://breakingdefense.com/2021/11/mda-hypersonic-missile-tracking-prototypes-on-point-for-2023-launch/>.

6. “Here Are the Three Companies Selected to Design Hypersonic Missile Interceptors For MDA,” *Defense News*, November 20, 2021, <https://www.defensenews.com/pentagon/2021/11/20/heres-the-three-companies-selected-to-design-hypersonic-missile-interceptors-for-md/>.

And the MDA also mentioned that the “airborne, boost-phase interceptor” may also be the choice of future countermeasure system deployments.⁷

2-3. US DoD to develop hypersonic missile detection technology

The Space Development Agency (SDA) under the US Department of Defense is also working with the MDA and launched a Prototype Infrared Payload (PIRPL) in August 2021. PIRPL is a multi-spectral infrared camera carried by the International Space Station as an experimental payload; it was originally used to study the background infrared generated by the Earth but can also be used to detect and track fast-flying hypersonic missiles. The low Earth orbit (approximately 100 km to 2,000 km in altitude) “tracking layer” of small satellites planned by SDA is aimed at detecting and tracking fast-moving hypersonic missiles with a new wide-range infrared sensor and a medium-range Hypersonic and Ballistic Space Sensor (HBTSS). The US DoD has

approved the launch of 10 “tracking layer” satellites and 20 “transmission layer” data communications relay satellites in 2022. Although not designed for tracking hypersonic missiles, the PIRPL still provides a demonstration of the ability to track weak infrared signals and how this capability can be taken advantage of.⁸

3. Trend Observation

Hypersonic missiles not only pose a new threat to the US but may also become a game-changer in future warfare. Matured hypersonic technology could significantly reduce the time of long-range flight; this has not only commercial potential, but also great military value. Today, both China and Russia are attempting to counter the leading ballistic missile defense system of the US and develop their own “counter-intervention” capabilities; the US, on the other hand, has not prioritized the development of hypersonic missiles and focused on

7. “MDA Sees EW, Cyber For Future Missile Defense,” *Breaking Defense*, June 22, 2021, <https://breakingdefense.com/2021/06/mda-sees-ew-cyber-for-future-missile-defense/>.

8. “DoD Launching Experiment For Space-Based Hypersonic Missile Detection,” *Breaking Defense*, August 10, 2021, <https://breakingdefense.com/2021/08/dod-launching-experiment-for-space-based-hypersonic-missile-detection/>.

developing traditional precision strike missiles instead. As the US failed multiple times when they tried to speed up the development and deployment of hypersonic weapons, they should re-examine the development process and pay more attention to the threat of hypersonic missiles.

3-1. Hypersonic missiles have become imminent threat

The proliferation of hypersonic missiles may evolve into an arms race. Following the successful launch or deployment of hypersonic missiles by China and Russia, North Korea has also claimed success in its tests. In January 2022, North Korea tested twice in one week, tallying three successful launches since the liftoff of the Hwasong-8 missile in September 2021.⁹ In China, the DF-

17 missile is already in service and may also be testing another hypersonic vehicle capable of orbiting in space or at the edge of the atmosphere.¹⁰ Russia intensively tested the Mach 9 Zircon hypersonic missile in 2021,¹¹ and successfully launched that missile from the vertical launch system on the Admiral Gorshkov cruiser, which hit the target 350 kilometers away at Mach 7.¹² In contrast, the US is lagging behind in the development of hypersonic weapons and has yet to begin deployment.

3-2. Proliferation of hypersonic weapons disturbs regional stability

As the US, Russia, China, and maybe some other countries are working hard on related development, hypersonic weapons are not only a factor of increased regional tension but may also reshape strategic

9. "North Korea Test-fires Mach 10 Hypersonic Missiles", *UDN News*, January 12, 2022. <https://udn.com/news/story/6809/6026632>

10. "China's Mysterious Hypersonic Test May Take a Page From DARPA's Past," *Breaking Defense*, November 24, 2021, <https://breakingdefense.com/2021/11/chinas-mysterious-hypersonic-test-may-take-a-page-from-darpas-past/>.

11. "Russia Test-fired Multiple "Zircon" Hypersonic Missiles, Can Reach Ukraine in 5 Minutes," *UDN News*, December 26, 2021. <https://udn.com/news/story/6809/5988964>

12. "Russia Says It Successfully Tested Hypersonic Missile Praised by Putin," *Reuters*, July 19, 2021, <https://www.reuters.com/world/europe/russia-conducts-ship-based-hypersonic-missile-test-ifax-cites-defence-ministry-2021-07-19/>.

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stability under the situation where countries are competing to deploy them. While the US is currently disadvantaged, China and Russia have gone all out to develop hypersonic missiles to counter the successful development and deployment of US missile defense systems for “balancing” the disadvantages of their inferior defensive capabilities. In contrast to the Russian hypersonic missiles equipped with both nuclear and conventional warheads, the US mainly uses conventional warheads for precision strikes. Some experts believe that even if Russia and China take the lead in hypersonic weapons, it would have little impact on the strategic balance between the powers; however, the hypersonic weapons deployed in some specific areas may increase the risk of regional conflicts due to the revolutionary changes in warfare patterns, and this must be taken into consideration by national strategy

planners.¹³

3-3. US needs to reconsider progress for developing hypersonic weapons

In order to catch up in the development of hypersonic weapons, the US has accelerated the process; between 2015 and 2020, the US increased hypersonic research funding by 740 percent. The technology is not just for missiles, but also for transportation and sensors on vehicles such as hypersonic reconnaissance aircraft. According to the 2022 US National Defense Authorization Act, billions of dollars are granted for the development of hypersonic weapons.¹⁴ In contrast to the mature ballistic missile defense system, the aggressive weapon development schedule of the US has led to a series of failures, and successes have been achieved only after the learned lessons and re-engineering. The US Government Accountability Office

13. “Hypersonic Missiles: Why the New “Arms Race” Is Going Nowhere Fast,” *Bulletin of the Atomic Scientists*, January 13, 2020, <https://thebulletin.org/2020/01/hypersonic-missiles-new-arms-race-going-nowhere-fast/>.

14. “Defense Spending Act Makes Hypersonic A Top Priority, Calling For Billions In Investment,” *CNBC*, December 21, 2021, <https://www.cnbc.com/2021/12/29/defense-act-makes-hypersonic-top-priority-calls-for-investing-billions.html>.

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(GAO) pointed out that the US uses new acquisition policies and processes when developing these weapons in the hope to develop prototypes within six months and begin deployment within a few years; and, similarly, hypersonic weapons are still facing immature technologies and overly aggressive timelines. If the development of hypersonic weapons is deemed necessary, the US Congress should review the development program and get it back on track.¹⁵ The current development of measures countering hypersonic weapons should in part take advantage of ballistic missile defense and matured hypersonic propulsion technology to avoid repeated mistakes.

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15 “Why Do US Hypersonic Missile Tests Keep Failing? They’re Going Too Fast,” *Defense One*, January 3, 2022, <https://www.defenseone.com/ideas/2022/01/why-do-us-hypersonic-missile-tests-keep-failing-theyre-going-too-fast/360276/>.