

# Current Status and Strategic Demands of Hypersonic Weapons Development in Medium-sized Countries

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## Abstract

As one of the emerging disruptive technologies, hypersonic weapons technology is gaining military significance and strategic attributes with the maturation of supercombustion ram engine technology. The superposition of emerging disruptive technologies can often bring "one plus one is more effective than two". Hypersonic weapons can break through the existing missile defense system and bring new changes to the world power pattern. In the context of both technological revolution and technology proliferation, the high technology involved in hypersonic weapon systems is increasingly mastered by more and more countries. The construction of hypersonic weapons in Japan, India, North Korea and South Korea is a representative example of the demand and strategic positioning of medium-sized countries for emerging disruptive technologies. Combined with the current arms control deficit and technology proliferation situation, the superimposed impact of hypersonic weapons development on the international security order and international strategic stability requires a comprehensive analysis in a global and systematic manner.

## Keywords

**Hypersonic Weapons; Middle Power; Development Current Situation; Strategic Importance.**

## 1. INTRODUCTION

Hypersonic weapon technology, as one of the emerging disruptive technologies, is in essence an enhancement and leap in carrier performance. The fast and sudden defense characteristics of hypersonic weapons break the offensive and defensive balance structure constructed by the current nuclear deterrence and missile defense system, and further impact international strategic stability in parallel with the nuclear-permanent characteristics of its combat wing. With the increasing complexity of great power competition and profound changes in the international game, the development of hypersonic weapons by major military powers not only represents the growth of their military power, but also symbolizes their grasp and innovation of disruptive technologies. Hypersonic weapons are increasingly used as a country's political capital to leverage the established international landscape. Since the end of the INF and ABM treaties, the U.S. and Russia have accelerated the development of intermediate-range missiles and promoted the process of hypersonic missile development, and the ensuing arms control deficit and proliferation of hypersonic weapons technology have had a significant impact on the current international security order. Unlike other disruptive technologies such as digital technology, artificial intelligence, and quantum information, the initial meaning of hypersonic weapons is for military applications. At the same time, disruptive technologies such as artificial intelligence and air and space technologies are constructing order in a relatively blank new field, and countries can, to a certain extent, seek cooperative development and crisis control through diplomatic means such as communication and dialogue. In contrast, hypersonic weapons have

the strategic and forward-looking nature of disruptive technologies, as well as the confrontational overtones of traditional military forces, and there are few strategic dialogues among countries about hypersonic weapons.

## **2. JAPAN AND INDIA DEVELOP HYPERSONIC WEAPONS FOR POWER-SEEKING PURPOSES**

Japan and India, as representative countries seeking political power status in the international arena, have the necessary strength to support their technological and military power. On November 18, 2019, Japan's Ministry of Defense announced that it will conduct simultaneous research and development programs for both boosted glide and cruise hypersonic missiles by 2030. Although Japan's official claim that its R&D program is for the defense of the outlying islands, but from the point of view of its technological growth and the degree of weapons common, Japan's hypersonic missiles in the range and vocalization method, there is still a threat to the adult radiation in Northeast Asia. TOKYO, Nov. 6, 2022 (AP) - Japan urgently needs to strengthen its military capabilities as security risks increase, including the threat of North Korea's nuclear and missile advances and Russia's war against Ukraine, Prime Minister Fumio Kishida said in an international fleet review. Japan's hypersonic weapons build-up, while bringing security pressure to Northeast Asian countries, further complements the U.S.-promoted "integrated deterrence" and provides the military conditions to become the fulcrum of the U.S. strategy in the Indo-Pacific, thus seeking to "unblock" its international affairs discourse and military power. (By Mari Yamaguchi, 2022) The "integrated deterrence" promoted by the U.S. Blinken said of U.S.-Japan military cooperation, "When Japanese and U.S. researchers play to their complementary strengths, we can outpace anyone and out-innovate anyone." (Owen Churchill,2022)

India's Defense Research and Development Organization (DRDO) said in 2020 that India could develop a complete hypersonic cruise missile system in the next four to five years that would strike targets at least twice as fast as the world's fastest current Brahmos supersonic cruise missile. The Defense Research and Development Organization tested the Hypersonic Technology Validation Vehicle (HSTDV) on Sept. 7, 2020, which is expected to lay the foundation for the development of a hypersonic cruise missile system. (Missile Defense Advocacy Alliance, 2020) Indian Prime Minister Narendra Modi congratulated the scientists involved in the development of the hypersonic system, noting that "few countries today have such a capability." (Kelsey Davenport, 2020) In addition to purchasing advanced hypersonic missiles and strengthening domestic technology development, India's hypersonic weapons development is also characterized by cooperation with leading technology countries. According to TASS news agency, the Brahmos-II cruise missile developed by Brahmos Aerospace, a joint venture between Russia and India, will have a series of advanced capabilities of the Zircon. India partnered with Russia in 2021 on its second hypersonic program, and the missile is now scheduled to achieve initial operational capability between 2025 and 2028. India has 12 hypersonic wind tunnels for testing speeds of up to Mach 13. (Kurus, 2021) India's hypersonic weapons development and R&D program has contributed to the transformation of the domestic defense industry and provided greater assurance of "self-sufficiency" in military force building. Despite setbacks, India's flight tests of its hypersonic vehicles demonstrate New Delhi's commitment to developing hypersonic technology. First, India aspires to be a world power. Indian Defense Minister Rajnath Singh has emphasized the importance of indigenous development of missiles, implying that India expects to be on par with the United States, Russia and China in terms of indigenous technological advances. Second, India sees China as an economic and political rival and may feel the need to catch up with China's emerging hypersonic

capabilities. Third, hypersonic weapons may complicate Pakistan's ability to develop countermeasures, thus giving India a strategic advantage over Pakistan. (Samran Ali, 2019) Finally, India's domestic political and scientific communities also drive this ambition. The development and testing of Indian hypersonic weapons has increased instability and uncertainty in the world's nuclear force landscape, and its hypersonic weapons build-up poses a threat to the security situation in South Asia.

India and Pakistan have nuclear warheads in the same range. Both India and Pakistan have developed short-range ballistic missiles, Pakistan with its nuclear Nasr missile and India with its conventional but nuclear-capable Prabhakar missile. Both are developing multiple independently targetable re-entry vehicle (MIRV) technologies. India's acquisition of hypersonic weapons, combined with enhanced Indian intelligence, surveillance and reconnaissance (ISR) capabilities, missile defense and nuclear submarines, could tip the strategic balance in India's favor. Combined, these systems are a powerful weapon for pre-emptive strikes. Pakistan may therefore be concerned about India's ability to pre-empt its strategic assets. In the event of a crisis, Pakistan may pre-emptively launch its own weapons for fear of losing them in an Indian decapitation strike. These concerns are further exacerbated by the declining credibility of India's no-first-use nuclear weapons policy. The ambiguity that accompanies hypersonic weapons is an added threat to nuclear stability in South Asia. The speed of hypersonic weapons increases their kinetic lethality, so that even conventionally equipped hypersonic weapons can wreak havoc. Thus, it is possible to successfully counterattack without the use of nuclear warheads. It may not be possible to determine whether a missile is carrying a conventional or nuclear warhead until it reaches its target. This ambiguity could allow a conventional attack to be mistaken for a nuclear attack and cause the incident to escalate to the nuclear threshold India has also rejected many of Pakistan's bilateral arms control proposals, including bilateral test ban agreements and strategic restraint regime agreements. India's hypersonic weapons would have serious consequences for Pakistan. Pakistan does not have ballistic and cruise missile defenses, while India is strengthening its air and missile defenses. Thus, Pakistan may eventually be pressured to develop or acquire its own hypersonic weapons unless global powers decide to stop the proliferation of such weapons, especially in South Asia. Pakistan may also be forced to make doctrinal changes, such as a more ambiguous policy on its nuclear use, or to make operational changes to enhance the readiness of its nuclear weapons. India may take advantage of the end of the INF and ABM treaties and the international arms control deficit to intensify missile technology development to heighten tensions in South Asia.

### **3. NORTH AND SOUTH KOREA DEVELOP HYPERSONIC WEAPONS OUT OF A NEED FOR NATIONAL SECURITY**

The DPRK nuclear issue is linked to almost all security concerns in Northeast Asia and involves many historical elements, and North Korea's nuclear weapons development is under pressure in the process of resolving the DPRK nuclear issue and building a security mechanism in Northeast Asia. After the strategic patience of the Obama administration and the extreme pressure of the Trump administration. The DPRK has destroyed part of its nuclear test site under severe sanctions and blockade, yet the U.S. has been slow to fulfill its pledges of assistance to the DPRK and has continued to repair the U.S.-Japan-South Korea military alliance since the Biden administration took office. Since the 1990s, the North Korean national economy has faced a prolonged recession. However, the DPRK has not relented in its development of nuclear weapons and missiles, which has consumed a great deal of human and material resources, and the development of its new strategic weapons is both an objective material guarantee for the

DPRK and a moral pillar for the domestic population. According to KCNA, the DPRK conducted several test launches of missiles in August and September 2021, including a test launch of the Mars-8 hypersonic missile on September 28 and an anti-aircraft missile on September 30 in Duryang-ri, Yonglim-gun, Jigang-do, and another test launch of the Mars-17 missile in late 2022. "According to South Korean media reports, the missile could reach Mach 20 speed and have a range of up to the U.S. mainland. Kim Jong-un told officials in the missile research department to "help strengthen the country's war deterrence through their continued ultra-modern scientific research results." He expressed "great expectations" for the future. (the Korea Times, 2022) Strengthening U.S.-Japan-South Korea trilateral military cooperation against the backdrop of the U.S. strategic shift to the Indo-Pacific region. While increasing security tensions in Northeast Asia, the North Korean nuclear issue is frequently used as an opportunity to encourage the transformation of Japan's defense policy and the building of South Korean military forces.

"The Mars-8 hypersonic missile is the first hypersonic weapon publicly mentioned by the DPRK, using a storable fuel system, an ampoule missile combustion system and engine for the first time, and equipped with a hypersonic glide flight combat section. "The successful test launch of the Mars-8 marks a strategic and groundbreaking development since the DPRK began developing the missile in 1987. The DPRK's new anti-aircraft missile uses important new technologies such as dual rudder control technology and dual pulse flight engines, and has a two-stage structure with a large solid booster and a duck-wing aerodynamic rudder design. And simultaneously equipped with launchers, radar, combat integrated command vehicle and other air defense missile systems. To a certain extent, it reflects the completeness of its existing weapon system. The DPRK conducted several missile test launches in August and September 2021, including a long-range cruise missile, a rail-mobile missile and a hypersonic missile. 2022 saw the DPRK continue its hypersonic weapons development and missile test launches, announcing in January that it had successfully test-fired other types of hypersonic missiles. 11 January 2022 claimed a maximum speed of Mach 10 for the test missile. The Yonhap News Agency cited experts from the Congressional Research Service (CRS) as saying that the Mars-8 is a hypersonic glider with a possible top speed of Mach 3, and that the ballistic missile launched last January was close to a "maneuverable re-entry warhead or vehicle" (MARV/MRV).

Increased competition among major powers has enhanced South Korea's sense of insecurity. In South Korea's 20th general election, the Yoon Seok-yeol administration came to power and launched a series of new foreign and defense policy initiatives based on the domestic situation. South Korea's hypersonic force construction is scheduled for a test flight in 2022 and is expected to be completed in 24 years. South Korea revealed plans to begin testing a ground-launched hypersonic cruise missile prototype in 2022. The next-generation hypersonic missile it plans to develop was shown in a promotional video at the Korea Defense Science and Technology Gala in 2021, in which South Korean defense science and technology researchers participated. The missile is similar in appearance to the Russian Zircon, which was once called a "copycat" by international critics, but from the perspective of technological growth, the future development of a sea-based version, together with the South Korean destroyer Sejong Daewang, will further enhance South Korea's influence in Northeast Asia. In May 2021, the Biden administration agreed to lift the ceiling on South Korea's ballistic missile range, which had previously been 497 miles. This decision is part of a 10-year process of steadily increasing payload and range limits following a 1979 U.S. agreement aimed at limiting the proliferation of ballistic missile technology. (Staff Writers,2021)

#### **4. MEDIUM POWER HYPERSONIC WEAPONS CONSTRUCTION IMPACT: CHANGES IN CONVENTIONAL STRIKE STATUS AND EFFECTS**

The hypersonic force building of medium power countries is more focused on the conventional strike domain, which mainly has an impact around both national comprehensive power and regional security and stability situation. For medium powers, the development of hypersonic weapons in the conventional domain can both enhance their military superiority and demonstrate their momentum in the development of emerging disruptive technologies. When a medium power with hypersonic weapons is in a competitive relationship with a country of similar overall power but without hypersonic weapons, its gaming capital based on military defense power will contribute to the increase of its discourse and influence. When dealing with a major power, the ability of hypersonic weapons to threaten the survivability of nuclear weapons can also help to gain some asymmetric advantage in negotiations. The hypothetical application scenario of hypersonic weapons has created momentum for national comprehensive power while also allowing the conventional domain to gradually gain momentum in strikes. Since the birth of nuclear weapons, their status as "absolute weapons" has remained widely perceived. If a conventional strike weapon were to emerge in the physical domain that could contain it, it would shake the effectiveness of nuclear deterrence while also affecting the position of the great powers. Another scenario of concern includes the construction of hypersonic weapons by U.S. allies, and in recent years the United States has promoted the piloting of the "integrated deterrence" concept in the Asia-Pacific region. In other words, the U.S. is promoting the concept of "integrated deterrence" in the Asia-Pacific region, which involves linking the nuclear forces of allies of medium-sized military powers to achieve cross-domain integration of forces in areas where potential future competition may arise. Referring to the concept at the Defense One Vision 2022 Summit, Deputy Secretary of Defense Colin Kahl said the concept "will affect almost everything we do. The secretary of state spoke of the need to continue to modernize the nuclear trinity to ensure that we have a safe, secure and effective nuclear deterrent as the ultimate support," he added. But we will also develop additional capabilities. At the end of the day, the entire coalition system is critical to integrated deterrence." (Jim Garamone, 2021)

#### **5. HYPERSONIC WEAPONS DEVELOPMENT OUTLOOK**

Hypersonic weapon systems link a number of emerging disruptive technologies, such as artificial intelligence, air and space, and have a significant impact on the development and transformation of future warfare.

##### **5.1. Hypersonic weapons overlaid with artificial intelligence: weaponization of artificial intelligence**

First, in terms of time-sensitivity. The rapid strike effectiveness of hypersonic weapons requires closer and more sensitive monitoring and response by missile defense systems. Take the U.S. Aegis Combat System as an example, the progression of its degree of automation cannot be achieved without the application of artificial intelligence technology. In both its combat operations and integrated defense, the application of artificial intelligence technology acts on the search, tracking and missile guidance functions of radar and many other joints. The extreme speed of hypersonic weapons greatly shortens the "window period" of missiles, and AI can conduct sensitive identification and even advance warning strikes within a shorter window to ensure the achievement of strategic objectives. The moral, ethical, and legal issues surrounding the use of AI for weapons of mass destruction will be further exacerbated when AI is involved in the decision-making aspects of strikes, including defensive strikes. This will involve the



second major characteristic of hypersonic weapons, namely the ambiguity of both nuclear and conventional weapons. There is still no unanimity in the world about the militarization of artificial intelligence, and the nuclear-permanent characteristics of hypersonic weapons will further stimulate the discussion on the above issues.

## 5.2. Hypersonic air-to-space aircraft concept: militarization of space

The airplane is a manned vehicle capable of maneuvering in the atmosphere and space, and has two aerospace functions. Although countries have not yet developed products with high practicality and applicability due to technical reasons such as engines, fuel and material structures, the huge strategic value of the airplane still motivates countries' interest in research and development. In addition to the fact that the technology is not fully mature, the high R&D threshold and the uncertainty of the economic effect of the product are one of the main considerations of all countries. With the success of the supercombustion ram engine flight experiment and the maturity of aerospace and material science technologies, it is only a matter of time before the technical threshold is broken. Its strategic value and economic utility become the key variables for countries to invest or not.

## 6. CONCLUSION

The concept of hypersonic air and space aircraft is expanding under the development of technology and strategic needs, the current technology frontier countries have basically achieved manned aircraft in the atmosphere of subfactor and supersonic flight, the next focus will be on the space sector. In recent years, the space commons has become the main battlefield for the world's major powers to seize strategic advantage, and countries have stepped up technology development and actual deployment to achieve a grasp of the strategic frontier. The process of space militarization will be further enhanced by the hypersonic airplane concept.

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