

Ethical Analysis of Hypersonic Weapons Used in the Russo-Ukrainian War

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Introduction

In the new era of weaponry, many new technologies are being utilized and shown off in warfare. However, the eye-catcher is the advances in hypersonics and the new-found hypersonic missiles. Hypersonics can be defined by the capability to reach Mach 5 (five times the speed of sound). However, hypersonic capability is not something new. Traditional Intercontinental Ballistic Missiles have been known to travel up to Mach 20 when reentering the atmosphere. Yet, these missiles travel to high altitudes, use gravity to reach their speed, and have very predictable flight paths. The new hypersonic missiles travel much slower, around Mach 10. However, these missiles travel at much lower altitudes and are very maneuverable, allowing them to pass by air-defense systems easily. Though there are different types of hypersonic weapons being unveiled, this paper will be focused on two main types: the hypersonic glide vehicles (HGV), and the hypersonic cruise missile (HCV). The term “hypersonic weapons” or “hypersonic missiles” is commonly used to reference HGV and HCV.

The necessity of these weapons arose from the existing Mutually Assured Destruction (MAD) architecture. MAD is defined as nuclear-capable militaries are deterred from initiating a nuclear attack due to the certainty of catastrophic consequences for both sides. However, technological upgrades have made it where the concept of MAD may not apply. A certain country was worried that their enemy defense systems got so advanced that they may be able to withstand a first strike. Thus, the need for a weapon that can target those defense systems increases, which leads to the development of hypersonic weapons.

Their fast speeds and different trajectories have caused them to receive new fame and interest in their effectiveness and capabilities on the battlefield. But what are the ethical debates that concur from these weapons and their usage? In this paper, I will examine the ethical issues

by examining the performance and usage of hypersonic weapons. To delve further into this, a specific case can be utilized to analyze the effectiveness of these hypersonic weapons: the Ukrainian War.

Discussion of Literature

Technical Capabilities

Hypersonic weapons are deemed a threat because of their speed, maneuverability, and low flight altitude. HGVs utilize a boost-glide method to reach their speeds, while HCVs use a scramjet engine. The Intermediate-Range Nuclear Forces (INF) Treaty, signed by former US President Ronald Reagan and Former Soviet General Secretary Mikhail Gorbachev on December 8, 1987, limits the capabilities of new hypersonic missiles by only allowing the missiles to spend less than half of their flight time in a ballistic trajectory. Due to these restrictions, the missiles must spend the majority of the flight time in a “glide” like manner, thus the name boost-glide. This limitation ensures that hypersonic development is controlled. This is seen as a positive for the victims of hypersonic weapons, but a negative for those trying to capitalize. Interestingly enough, the United States withdrew from this treaty in 2019 citing multiple violations from Russia starting from 2013. In older weapons that use ballistic trajectories, radar defense systems can locate the missile early on because of how high the missile is flying. HGV instead flies up to Low Earth Orbit (LEO), which is around 100 km above sea level, then falls back towards Earth, using gravity to gain its speeds. The vehicle then glides for the remainder of the trajectory until it reaches its target. This method uses the boost-glide method which was written in the IVF Treaty. Since the glide vehicle is so low to the ground, radar is only able to detect the vehicle until the missile is much closer. Upon detection, defense systems may potentially have a single interception attempt toward the missile. An HCV uses airbreathing propulsion, usually a

scramjet, to gain speeds. Since a scramjet engine can only operate under supersonic conditions (faster than the speed of sound), an HCV must use a catalyst to first reach Mach 1. This is usually done by a fighter jet. Once the jet reaches supersonic speeds, the HCV can be launched, where it will reach speeds faster than Mach 5.

The Congressional report on hypersonic weapons stated that “U.S. defense officials have determined that both terrestrial- and current space-based sensors are insufficient to detect and track hypersonic weapons ”(Saylor, 2019). These weapons will primarily be used to neutralize current defense systems. President Putin, in response to the U.S. military advancements, stated, "If we do not do something, eventually this will result in the complete devaluation of Russia’s nuclear potential. Meaning that all of our missiles could simply be intercepted” (Putin, 2018). In the situation of MAD, Russia fears the U.S. missile defenses are too advanced that a second strike from Russia will be useless. Thus, they developed hypersonic weapons to penetrate the missile defense systems, bringing MAD into play. China also stated similar reasons for its development of hypersonic weapons.

Ethical Considerations

The emergence of hypersonic weapons brings into consideration the ethics that surround them. The question of whether nukes will be armed with these weapons brings in the ethical dilemmas associated with nuclear weapons. Russia and China’s hypersonic weapons can be fitted to incorporate a nuclear warhead, while the U.S. cannot be fitted with a nuclear warhead. The capability for nuclear attacks on this weapon adds another layer to the existing MAD structure. The first layer was protecting the structure by destroying defense systems and ensuring both countries were struck. However, if the hypersonic speed and maneuverability of these weapons were combined with nuclear potential, it would create a situation where a country could conduct

a first strike that is not noticed until it is too late. In the case of having a hypersonic weapon flying toward a target with an unconfirmed payload, it can lead to countries assuming the worst-case scenario and preparing for a nuclear fallout. Certain countries, like the United States, only allow non-nuclear payloads on their hypersonic missiles. They do this to mitigate fears and uncertainty about whether a hypersonic missile flying toward a country contains a nuclear payload or not. However, countries like Russia and China have hypersonic missiles that can be fitted with both traditional warheads and nuclear warheads.

Discussion of Case

The Russo-Ukrainian war started in February of 2014 and has seen a revamp in action in 2021. Of the fifteen Soviet Republics that formed after the collapse of the Soviet Union in December 1991, Ukraine was the second-most populous and powerful, second only to Russia. The country contained the majority of the union's agricultural production, defense industries, and military (Masters, 2023). There were many reasons why Russia wanted to invade Ukraine. According to a census taken in 2001, approximately eight million ethnic Russians lived in Ukraine. Moscow believed it was their duty to protect these people, and used that reasoning to invade Crimea in 2014. Russia also fears that NATO's sphere of influence is reaching too close to Russia. NATO, or the North Atlantic Treaty Organization, was created in April 1949 by 12 countries from Europe and North America and the primary purpose was to have collective security against the Soviet Union (Office of the Historian, n.d.). NATO continued to expand its influence post-Cold War, adding 20 countries. This expansion led to the Kremlin's growing resentment towards NATO. Before NATO's 2008 summit, President Vladimir Putin stated that bringing Ukraine into the alliance "would be a hostile act towards Russia", (Masters, 2023). Putin prefers to have Ukraine under his sphere of influence and wants to recreate the former

Soviet Union's power. However, the increasing influence of NATO led to Russia's invasion of Ukraine. Russia, being more technologically advanced, has used this conflict as a testing ground for its hypersonic weapons.

The Russian military currently employs the usage of the Kinzhal missile and has started to operate the Zircon missile as of February 2024. The Kinzhal and the Zircon are classified as hypersonic weapons, but they utilize a different method of reaching hypersonic speeds from their counterparts. Though the Kinzhal does not fall under the typical HCV and HGV categories, it is a hypersonic air-launched ballistic missile and is the first hypersonic weapon to be used in warfare. The Kinzhal missile is deployed from a MiG-31K or Tu-22M3, which are aircraft with supersonic capability, going Mach 2.7 (Spectrum, 2023), and then the rocket engine allows the missile to reach Mach 10.

The 3M22 Zircon, or the 3M22 Tsirkon, is a two-stage missile that utilizes solid fuel and a scramjet motor in the first and second stages, respectively (MDAA, 2024). The Zircon does not follow the boost-glide restriction and is classified as a cruise missile, which uses scramjet engines to reach hypersonic speeds. Avangard is Russia's HGV design. This missile follows the boost-glide requirements strictly and contains no independent propulsion system. This system carries a nuclear warhead that is reportedly more than 2 megatons of TNT. For comparison, the bombs dropped on Hiroshima and Nagasaki during WWII had around 20,000 tons of TNT.

As for the effectiveness of these new weapons in the Russo-Ukrainian War, the impact is minimal. There have been multiple reports of the Kinzhal being shot down and not reaching the marketed speeds. In a report from China, who also have their hypersonic weapons developed and in operation, they deem the Kinzhal as "outdated 1980s Cold War technology that is not genuinely hypersonic in nature." Along with its reduced speeds, China also points out the severe

lack of maneuverability of the missile and that it does not reach its intended distance (Diplomat, 2024). This underperformance of the Kinzhal does not come as a surprise. These missiles were marked as impervious to current air defense systems. However, as the war prolonged, more reports of the Kinzhal missile being shot down continued to appear. Ukraine operates the United States MIM-104 Patriot defense system. The Patriot system started operations during the Cold War era and is still functioning today. It has undergone multiple upgrades and can reach Mach 6. On May 9th, 2023, the United States publicly confirmed that Ukrainian forces shot down at least one Kinzhal missile using the Patriot defense system. This marks the first confirmed interception of the new hypersonic weapons. A total of 15 Kinzhal missiles have been shot down through the Patriot missile. This puts the reputation of Russia and its new missiles into question since Russia proclaimed that its new missiles could reach Mach 10. If this were the reality, the Patriot system, whose maximum speeds are at Mach 6, would be unable to neutralize the Kinzhals speeds. However, with new reports of Kinzhals being shot down, the credibility of Russia has diminished. Russia also did not expect the war to last this long and has started to run low in its supply of Kinzhal missiles. This could be the reason why Russia started to utilize the Zircon.

On February 7, 2024, Zircon was used to attack targets in Kyiv, the Ukrainian capital. As for whether this new missile meets its proclaimed statistics, it is too early to determine. As of writing this paper on February 23, 2024, there has only been one confirmed usage of the Zircon in the Russo-Ukrainian war. In the case of the Russo-Ukrainian war, Russian action has been seen as aggressive and unethical by most. Their continued attack on the Ukrainians has led to many calls for them to leave Ukraine. On March 2nd, 2022, the UN General Assembly voted 141 against 5 for a resolution rejecting Russia's invasion of Ukraine, and they demanded that Russia obey international law and withdraw its forces (EEAS, 2022). However, these calls have been

unfilled and Russia continues to engage Ukrainian forces. With the utilization of the newly showcased hypersonic weapons, Russia has been keen to have them tested. On August 8, 2023, two Russian Hypersonic missiles hit Odessa, which is around 30 miles from the Eastern Ukraine Frontline, damaging an apartment building and a hotel that was popular with international journalists. The strikes resulted in seven people killed and 81 more wounded (Inocencio et al., 2023). Another instance of this occurred on January 2, 2024. Russia launched multiple missiles towards Kyiv and Kharkiv, the two largest cities in Ukraine. There were reported 100 various types of missiles launched at these cities, but all 10 of the Russian Kinzhal missiles were reported shot down by air defenses. However, the priority focus on the Kinzhal meant the other missiles could reach their targets. The strikes resulted in 5 confirmed deaths and nearly 130 injured (PBS, 2024). These strikes violate known principles of war and will be explored in the next section.

Analysis

The emergence of hypersonic weapons is still recent and has only been used in one case so far, the Russo-Ukrainian War. These weapons were created to use their speeds and maneuverability to attack defense systems. However, they are used to target civilian populations and incite fear. This can be seen in strikes in Odessa on August 8, 2023. Two Russian hypersonic weapons damaged civilian structures that were not related to the war. However, the darker part of this strike was that the second missile struck 40 minutes after the first. After the first strike, Ukrainian fire and rescue workers rushed to the strike to rescue people and put out fires. This led to many of the wounded from the two strikes being Ukrainian fire and rescue workers who were struck by the second missile while trying to rescue others from the first explosion. This raises the question if Russia is using its missiles to target military bases or if they are insinuating fear

toward the general population through these strikes. The usage of the second strike 40 minutes after the first one in the same location can be seen as a violation of the principles of discrimination. It is expected that civilian emergency workers will arrive on site for a missile strike to assist the local population. Thus, Russia should have known that striking in that same region again would lead to an attack on the emergency workers. This not only attacks the protected civilians but also the emergency workers.

In the other strike on January 2, 2024, Russia launched 100 different types of missiles towards two of the most populated cities in Ukraine. This event brings into question the principles of discrimination and proportionality. Russia's decision to attack the two most populous cities in Ukraine raises the question of whether they intended to strike military bases or civilians. Russia claims they were used to attack Kyiv's defense industry, but the barrages ended up striking urban areas like housing and shopping malls (AP NEWS, 2024). However, the hypersonic missiles used in these attacks were all shot down. This is caused by the priority focus on hypersonic weapons.

Their lethality comes from the combination of speed and heavier warheads. The sheer kinetic energy added to the payload creates a more devastating strike zone. Thus priority treatment is given to these weapons and the effects can be seen from the strike on January 2nd. Russia's using these hypersonic weapons on civilian populations has created a lot of media coverage. The Zircon, which was created to be a hypersonic missile that targets aircraft carriers, was used in a civilian shopping center. In addition to this, every time Russia's hypersonic weapons are used, Ukraine has to worry if it is carrying a nuclear payload. Each one of the hypersonic weapons mentioned earlier can use both nuclear and conventional payloads. Only the United States' new hypersonic weapons cannot. The United States calls its hypersonic program

CPS or Conventional Prompt Strike, with an emphasis on conventional or non-nuclear payload. Overall, Russia is only just starting to use its new hypersonic arsenal. The Kinzhal hypersonic missile lacks the maneuverability that the HGV and HCV missiles that Russia uses. The Zircon, which is an HCV, was first used in February of 2024. This is three years after the revamp of the Russo-Ukrainian War.

Currently, the hypersonic weapons used have not lived up to the reputation that has been created for them. However, it is important to note that Russia's hypersonic capabilities are deemed to be on the lower end. So though the structure of MAD may not be fully threatened, the same may not be true for the future. These weapons are still a very viable threat and the misuse of these weapons can have consequential results. From the way the paper from China was written, it seems China's hypersonic weapons live up to its reputation. Thus, though we have not seen hypersonic weapons used in the Ukrainian War to be a credible threat to the existing MAD structure, it is important to prepare for the time when hypersonic weapons live up to their capabilities.

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