

Hypersonic Weapon Systems as an Indicator of Changes in Concepts and Theories

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Since the hypersonic weapon system has gotten into service, the military strategists try to assess what changes the new capability will cause in the current theories and concepts. Even though there is much discredit around the effectiveness of the system, everyone agrees that it will shape and change the security environment. However, the first worries focused on the changes of current nuclear strategy, inherently the weapon will implicate other significant changes in the character of war. At the theory level, the capability of the system can override the current A2AD concepts, it can compel the adversary by bargain power and it can also put the current warfighting concepts at risk. Therefore, the analysis should focus on every segment of the current concepts and theories to predict how the system changes and shape military science.

Keywords: *hypersonic, coercion theory, warfighting concept, competition continuum*

Introduction

Regarding future conflicts, nobody can predict what it will look like, but Clausewitz's theory will remain: "War is the realm of uncertainty."² Within the uncertainty, all nations want to avoid the long and costly war; therefore, the modern military technology is always looking for two main factors to ensure the effectiveness in combat: speed and distance.

Speed has multiple importance; the first is the ability to overwhelm the opponent and exploit the success; this was the central idea of the Blitzkrieg, the "Shock and Awe",³ and it will probably remain dominant in the Multi-Domain Operation concept.

The second is the speed of the mobilisation and deployment, and how quickly can a nation project be a military power for the designated area. The distance highlights the importance of how closely the military should allocate or manoeuvre the weapon systems to ensure providing the desired effects. When a weapon system is flying at 27 times the

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² CLAUSEWITZ 1976: 101.

³ KLARE 2019.

speed of voice,⁴ and relatively has no distance limitation, it will shape and affect the two main factors at the strategic and operational level.

Wake up call of hypersonic threat

When Russian Defence Minister Sergei Shoigu announced that the Avangard hypersonic weapon system is operational and entered its service on 27 December 2019,⁵ it may be an indicator of a challenge of changes. Even though the Avangard entered the service, the effectiveness (accuracy, distance, active measures, etc.) of the system is still questionable. Maybe it is also part of the Russian military deception or ‘maskirovka’,⁶ but the initial success of the system set up different considerations.

Some of the current journals and articles say that “it’s an impressive technical achievement but solves a problem that doesn’t actually exist”.⁷ The fundamental of this scepticism is focusing only on the nuclear applications of the weapon system, and ignores the fact what kind of advantages could bring to the table the conventional warhead capability.

The advanced hypersonic weapon system capability is a game-changer, and it provides a significant advantage to super, or major powers by challenging each other’s coercion capability; and creating a critical vulnerability in the current warfighting concepts.

Hypersonic weapons are categorised as traveling faster than Mach 5, and currently include three major classes: ballistic missiles, boost-glide vehicles and cruise missiles.⁸ The ballistic category remains the same as was for decades with some improvement. But the other two types are relatively new. Hypersonic boost-glide vehicles are launched by rockets and their flatter trajectory allows the vehicle to re-enter the upper atmosphere. At this point, it uses an aerodynamic lift to go glide as it slowly descends in altitude.⁹ The cruise missile has a smaller platform; therefore, it can be launched from a ship or airplane, it does not leave the atmosphere, and because it must carry the fuel, the range is shorter than the boost-glide vehicle.¹⁰

The most advanced hypersonic weapon currently is the Russian Avangard the deployment of which goes back for 30 years of research.¹¹ In accordance with the Russian publications, the weapon hit a practice target 6,000 km away in a test launch at the Dombarovskiy missile base in the southern Ural Mountains.¹² The impressive capability performance is not coming only from the sharp manoeuvres, but it has active

⁴ MIZOKAMI 2019.

⁵ MARCUS 2019.

⁶ Maskirovka (маскировка [disguise]) Russian military deception, is a military doctrine developed from the start of the twentieth century. The doctrine covers a broad range of measures for military deception, from camouflage to denial and deception (https://en.wikipedia.org/wiki/Russian_military_deception).

⁷ MIZOKAMI 2019.

⁸ WILKENING 2019.

⁹ WILKENING 2019.

¹⁰ KLARE 2019.

¹¹ MIZOKAMI 2019.

¹² MARCUS 2019.

countermeasures during the flight and has the versatility to carry multiple warheads. The multiple warhead can include nuclear, which can carry two megatons, (comparing with Hiroshima that was 16 kilotons), and conventional warheads.¹³

Hypersonic effects on the spot: Nuclear or conventional?

Even though the current defence systems cannot deal with the hypersonic weapon threat, it is not the nuclear strategy that suffers the inherent challenges. The average nuclear missile defence systems are designed against rogue nations' (such as Iran or North Korea) or extreme violent organisations' single asset-nuclear strike not against Russia.¹⁴ Russia has too many nuclear weapons to deploy a strike, therefore, the mutually assured destruction (MAD) remains the holdback concept. While the rogue nations do not have the hypersonic capability, the super, or major powers have time to develop new missile defence systems or other counter-measures.

However, the hypersonic weapon systems are not the only consideration of the unnecessary arms race, the United States and Russia agreed to extend for five years the New Strategic Arms Reduction Treaty (New START) on 3 February 2021. The focus of the agreement is still the nuclear capability, and to limit the number of warheads, missiles, bombers and launchers.¹⁵ These kinds of acts can be acceptable as cooperation within the competition continuum to maintain the balance of strategic capabilities. Although the treaty only monitors and does neither limit the number of non-deployed launchers nor prohibit deploying conventional warheads on them. The strategic level consideration is that START can be applied to hypersonic weapon systems, if the conventional warhead application is not limited.

The conventional warhead application probably can bring more advantages and create changes in combat and theories. That is why there is interest in hypersonic weapons because they could be used for coercion assets or pre-emptive strikes to attack high value and high pay off targets and denial of the adversary's anti-access/area denial (A2AD) systems.¹⁶

The competition continuum requires a kind of balance within the capabilities to maintain the international relationships and avoid war. Therefore, the START agreement can restrict the unnecessary arms race on nuclear weapons, but it cannot hold back the further development of other strategic-level capabilities.

On the other hand, the sunk cost problem predicts the other application of the hypersonic weapon systems. The resource consumption of the development of hypersonic weapon systems is already high. The achieved successes probably are not game-changers in the current nuclear strategy concepts, but the temptation of the new capability of speed

¹³ MARCUS 2019.

¹⁴ MIZOKAMI 2019.

¹⁵ BUGOS 2022.

¹⁶ KLARE 2019.

and distance in conjunct of low circular error probable (CEP) would shape the doctrines and concept to provide *raison d'être* for them.

The multi-domain concept already divided the battle areas for different segments, and the deep fire area is relatively new in concept. This area is described as beyond the feasible range of the conventional manoeuvre forces, but the strategic effect is much desired to shape the follow-on phases of the operation.¹⁷ Considering the capabilities of the hypersonic weapon systems within the A2AD environment, and the necessity of avoiding the sunk cost of the development, the solution of application is already at hand.

Hypersonic as challenger of theories and concepts

The first, that ultimately has already been challenged, is the coercion theory. In accordance with coercion theory, there are three different acts: deter (by the threat of punishment or by the threat of denial), compellence and brute force. As the enemy or adversary acts, the method of the reaction changes as well. The primary concept of deterrence is to avoid war, while compellence is the tool to enforce the enemy to stop the actual actions to avoid the escalation of conflict. The brute force is the ruthless solution, when the adversary is not cooperating and the conflict is inevitable.¹⁸

Coercion – even if it is deterrence, compellence or brute force – in many cases requires deployment to ensure that the speed and the distance are suitable considerations. Denial as a most effective coercion¹⁹ must be within the striking range of the air force to undermine an adversary's ability to attain military aims.

Airpower is a coercive tool of choice providing high precision effects on discrete targets, or in the role of denial, it can disrupt military supplies and destroy key military infrastructure. Doing so, airpower can provide coercion in four types: punishment, denial, risk and decapitation.²⁰ Most of the currently issued aircraft still possess distance limitations, therefore, the aircraft carrier gets them close enough to ensure the desired coercion effect, what is usually called 'gunboat diplomacy'.²¹

Moreover, to ensure the survivability of the air assets in complex A2AD environment, other supporting capabilities are required to cover or guard their actions. The cost of the hypersonic missile is unknown by the author, but the assumption is that it is not close to the price of modern aircraft. Therefore, the risk of the operation is not the same, because the loss of the equipment and the highly trained pilot is inherently included in the mission of the airstrike. While the application cost of the hypersonic weapon system is added at the moment of the launch, and the risk is limited to the measurement of effectiveness and the effects on the escalation of the conflict. Obviously, the aircraft can execute more missions, or is even able to strike multiple targets, while the hypersonic weapon system can target one critical object, the balance of risk and costs are still worth considering.

¹⁷ PERKINS 2017.

¹⁸ BIDDLE 2020.

¹⁹ BIDDLE 2020.

²⁰ BIDDLE 2020.

²¹ GHOSH 2001.

While the air force assets owned the capability and the capacity for being the coercive tool with some limitation, the hypersonic weapon systems are the pretenders in many segments. ‘Gunboat diplomacy’ as a coercion action has still one significant advantage, it is marginal. The theory in practice probably requires some real movement to ensure the commitment of the act of force if needed. However, the unseen threat does not mean that it can be ignored. Knowing the fact that the strike can come at any time, to any critical location and there is no defence capability to react, is another kind of bargaining power. Moreover, if someone tries to compel and we have the tool of the threat of denying, it is a counter-bargaining power too.

The distance and the speed are ensured even from the homeland to compel other state or actor or can be considered as extended A2AD capability as deterrence by threat of denial. Doing so, it is vital to locate the critical assets or strategic allocation. Finding a fleet or locating an Airport of Debarkation (APOD) or Seaport of Debarkation (SPOD) is not a challenge with the current intelligence, surveillance and reconnaissance (ISR) technology. The hypersonic weapon system with conventional warheads can strike these key targets or locations with extended range consideration in extremely improved speed when the current defence systems are not able to deal with it.

Probably the current hypersonic weapon systems do not have this level of accuracy today, but even the slim chance to pose this threat is already a game-changer. At the theory level, hypersonic weapons are the perfect coercion assets because they can deny strategic movements, and they can decapitate the ability to fight. However, the application of the weapon system in this strategic distance has an inherent risk that is described as ‘warhead ambiguity’. The detection and the attack assessment is getting more complicated because a hypersonic boost-glide vehicle can manoeuvre hundreds of kilometres in cross-range during their glide phase, and the target remains uncertain.²² The risk that the defending nation has no time to assess the target and the warhead type and assume the worst, it is launching a nuclear strike.²³ This risk assessment sounds logical, but what if the adversary sends a direct strategic message, that if the crisis is escalating, he will use hypersonic weapons with conventional warheads to degrade the strategic movement capability. Does it justify any nuclear strike knowing that mutually assured destruction is still a valid concept?

Of course, hypersonic weapon systems have different coercive effects or effectiveness on different states or actors. The near-peer competitors try to keep up the continuum developing the measures and counter-measures. But the capability balance is just one part of the problem, and the way how to use it most effectively is another part. If it does not get right, it will be “the Maginot Line of the 21st century”²⁴ as P. W. Singer described the same challenges for robotic systems.

The others who are not considered near-peer competitors, the weapon is the ultimate asset to suffer the consequences. While the effective counter-measures are not at hand,

²² WILKENING 2019.

²³ KLARE 2019.

²⁴ SINGER 2010: 210.

the small nations and actors “can find [themselves] utterly defenseless”²⁵ as Clausewitz referred. Therefore, the coercion theory is not limited to distance and speed by the major powers to ensure they will hopefully just avoid a war.

Probably the strategic level application includes too high risks today; the operational level advantages are already challenging the current warfighting concepts. Overviewing the U.S. military boxer’s stance, as a warfighting concept, it is described as the strength, agility and resilience required to fight and win against any potential adversary.²⁶ The critical vulnerability is coming from the dependence on reliable communication, high-speed data links, sophisticated weapon tracking radar and long-range strike capable systems. Targeting those systems is very difficult while they are moving. But they must stop for a short period to operate, and this provides a window of opportunity to destroy, but it also requires a weapon system in short-range or very high speed travel.²⁷ As an example, Russia already has an air-launched anti-ship missile, called Kinzhal, traveling speed is 10 Mach to range up to 1,200 miles,²⁸ and the Iskander Mobile missile transporter–erector launchers (TELS) can attack conventional targets up to 500 km.²⁹

In the joint warfighting concept, the loss of critical assets predicts two kinds of challenges: quantitative incompetence and the undesirable asymmetric capability ratio. Most of the critical assets (as radars, TELS, ships, etc.) are costly tools, and even a superpower cannot afford to create a massive amount of reserve. Therefore, the supplement of the lost assets is creating a costly or unaffordable war. Moreover, the worst-case scenario is if the friendly joint force loses its critical assets, but the adversary does not. It creates an undesirable asymmetric capability ratio, where even the small tactical units remain unharmed; the operational-level support does not exist for them anymore, and they are vulnerable to the adversary long-range and cross-domain effects.

Of course, the challenge already has created many counter-measure visions and research and development (RAND) efforts. The Directed Energy Weapons (DEW) are capable of destroying targets within a limited line of sight, but it requires fast detecting and a precise targeting process. The high-powered microwaves can fry the processors, or at least may prevent the weapon from fusing, therefore, they are very promising as counter-measure against the threat.³⁰ Both development concepts have some critical vulnerability, even if it comes from the range, reaction time, or power support requirements. The advantage of the microwave is that it does not require precise targeting, because the invisible wave is wider, however, the same advantage could be a disadvantage too, if the target location is covered by the allocation of other friendly elements. Moreover, any single solution cannot answer for the complex challenge; the application of hypersonic weapon systems with other domains or weapon systems jointly can override the advanced defence capability.

²⁵ CLAUSEWITZ 1976: 77.

²⁶ DUNFORD 2017.

²⁷ WILKENING 2019.

²⁸ KLARE 2019.

²⁹ Army Technology 2017.

³⁰ VENABLE–ABERCROMBIE 2019.

Many weapons can be employed for offensive and defensive purposes, but hypersonic weapons are primarily offensive.³¹ If any super or major power would like to maintain a competitive advantage, it requires a comprehensive effort. The development of the hypersonic weapon and countermeasures is not enough. It needs revising the current warfighting concepts. The advantages of modern technology affect two of the principles of Joint Operations: mass and simplicity. The mass revised means is the mass of effects in offense and countermeasures, and the simplicity will lose the significance because the future combat is probably inherently complex.

In order to answer these challenges, it is a fundamental approach to ask the right question. The current analysis of the hypersonic weapon systems is focusing on the assets per se, however, the good question probably is how the hypersonic weapon systems can challenge the current coercion theory and can change the current warfighting concepts as a part of a multi-domain cross effects tool? The theory is far from any concept at the moment, but it seems to be a fact that the capability of what the missiles can bring to the table cannot be ignored. If Clausewitz is still right, and the war is thus an act of force to compel our enemy to do our will,³² the existence of a tool that can pose decapitation power theoretically, already can be considered the power of compellence with a different way of an act of force.

Conclusions

Winston Churchill's words "Generals are always prepared to fight the last war" are truer than ever, and the global arms race seems inevitable. While the battlespace and domain are expanding, and the purpose and the character of war is changing, the critical capabilities needed for deterrence or achieving strategic goals are persistently going through different evolution.

All states try to avoid becoming utterly defenceless and do everything to keep the right balance in the competition continuum by technical developments and doctrinal reviews. Nonetheless, the new START is a proper initiative to limit the nuclear arms race, but less to restrict other further races to compensate for the effects in the arms race that the hypersonic weapon systems already have initiated. The effects that the system can bring to the table should be compensated even in defence systems, or in other capabilities – even offensive – in other domains.

While the hypersonic weapon systems are on the spot, and different studies agreed that the nuclear strategy will not change dramatically, other segments of the arms race are already speeded up. On the one hand, other states do not want to fall behind the hypersonic technologies, therefore, they invest heavily to keep up the tempo. Moreover, there are other segments of the system that needs improvement such as current hypersonic weapon circular error probable reliability or increase the range or speed, and last but not least improve the usability of the system.

³¹ KLARE 2019.

³² CLAUSEWITZ 1976: 75.

On the other hand, the necessity of the counter-measures against the hypersonic weapon systems is generating other critical investments that are creating another type of vicious cycle within the arms race. None of the counter-measures considers a single silver bullet, because the effectiveness of the hypersonic weapon systems depends on the creativity of the adversary. It can be combined with other strategic capability or simply other kinetic- or non-kinetic element that could make the damage so effective. While the counter-measures are developing to answer the hypersonic challenges, the ready-to-use products could provide unique capabilities that can be used for another purpose, therefore, the vicious arms race is regenerating itself.

As Russian General Chief of the General Staff Valery Gerasimov described: “Each war is a unique case, demanding the establishment of a particular logic and not the application of some template”.³³ The future competition or conflict requires different methods of thinking in the matter of distance, the array of forces, integrated protection, intelligence, synchronised effects, expanded sustainment and cross-domain information. The advantage that the modern weapon systems bring to the table is inherently questioning the ‘raison d’être’ of the current warfighting concepts. Having a military power that cannot answer to these kinds of threats is already defenceless. Depending on what is the purpose of political objectives, the hypersonic weapon threat can set up a preferred condition to put the enemy in a situation that is more unpleasant than the sacrifice the call on him can make.³⁴

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³³ COALSON 2014.

³⁴ CLAUSEWITZ 1976: 77.

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