Analiza
Zakładu Bezpieczeństwa Narodowego UJ
ZBN
Nr 4 (43) / 2019 15 marca 2019 r.

Hypersonic Missiles – A Political Multipurpose Weapon

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Hypersonic weapons have recently become a very popular leitmotif of the debates concerning national security of many nation-states and international security as a whole. Hypersonics technology gets attention mainly because it is often supposed to alter the existing strategic balance. Therefore, on the one hand, the new weapons systems have been loudly advertised by Russia which claims to have achieved a virtual invincibility thanks to this *wunderwaffe*. On the other hand, in the U.S., and to a lesser extent in the other Western countries, there is a chorus of alarming voices calling for higher funding and quicker pace of research and development (R&D) efforts to develop their own hypersonic weapons and to create capabilities to counter the enemy's systems of that sort. In addition, China has its own vast and secretive weapons development program, hypersonic missiles included. It is, therefore, worth to review this issue and try to grasp a real impact of the new but steadily maturing technologies on international security.

Hypersonic weapons 101

Let us start with the basics.

The Mach number (Ma or M) is a physical unit of measure named after the Austrian mathematician Ernst Mach, in use since 1929. It refers to the velocity of an object traveling through the air relative to the current speed of sound. A need to use this measure, instead of fixed units, stems from the fact that properties of an airflow change according to a velocity of a craft relative to the speed of sound. Starting at the so-called transonic speeds (from Ma 0,8 on) an aircraft becomes subject to physical phenomena not occurring at lower speeds. The most violent of them is a well-known "sonic boom" which happens when an aircraft crosses the threshold of Mach 1. At higher, so-called supersonic, speeds even more important

changes to the properties of the airflow take place affecting an aircraft more and more as its speed increases. Around Mach 5 an airflow gains some very important characteristics entirely absent at lower velocities, hence the special term "hypersonic flow". That is why the word "hypersonic" refers to a vehicle that travels with a speed Ma 5 or higher in the atmosphere below 90 km, where the air is dense enough to make the sound a relevant factor.

A hypersonic craft may be unpowered or powered. The former refers to objects either falling along ballistic trajectories or gliding with the use of some lift produced by a vehicle while it moves through the air. The latter refers to an object which is constantly propelled, what allows it to sustain a certain altitude, for it is able to produce sufficient thrust to maintain its lift. Hence, other flying objects aside, the most general division of hypersonic missiles entails the three following categories:

– The first one consists of a huge family of ballistic missiles, represented by several categories which differ in speed, range, and other properties. They, or their warheads, usually become hypersonic objects when they come back to the atmosphere traveling along a ballistic path. For example, as a warhead of an Intercontinental Ballistic Missile (ICBM) descends to some 90 km above the ground, it may fly even 7 km/s – it is Ma 24 at this altitude. Note that a vehicle of this kind must survive harsh conditions of atmospheric re-entry, including temperatures up to 11 000 C, but for several seconds only, until the missile or its warhead gets to the altitude at which a nuclear device is activated or it hits a target on the ground. It is, let us say, a traditional, widely used and well-known hypersonic vehicle – though note that it is not commonly referred to as such.

– The second category of hypersonic missiles entails the so-called boost-glide vehicles, aka hypersonic glide vehicles (HGV). This term refers, in the most general understanding, to an unpowered re-entry craft which is accelerated by a rocket motor (or motors) of its launcher and then is jettisoned at some altitude. After the release, it ascends and subsequently descends along a ballistic trajectory for some time until it comes back to the atmosphere (it may also skip this ballistic part of the flight at the expense of its length). Upon re-entry, instead of continuing on the same path as a common ballistic warhead would do, a HGV maneuvers to level its flight more or less and to glide on using the lift provided by the air. If a booster is an ICBM-class rocket, a glider may indeed achieve some Ma 20-25 at the altitude of 60-90 km. But at the moment it starts maneuvering it also decelerates – the more tangential to horizontal is its flight path, and the lower it flies, the more rapid deceleration occurs because of mounting atmospheric drag. After some thousands of kilometers of glide, including evasive maneuvers, this craft may slow down to Ma 5. This would be its final attack speed for the last several hundred kilometers. The lower such a vehicle travels, the heat it must sustain grows, as it is generated by friction with increasingly dense layers of the atmosphere. A weapon of this kind is surely superior to a common ballistic missile, because if fired at a comparable distance it may cover it flying at lower altitudes. Firstly, because its ballistic trajectory's apogee is lower and further away from a target area. Secondly, because of its ability to glide re-enters the atmosphere at a significantly greater distance from its point of impact. These features contribute to the shortening of a warning and reaction time of defenses and, consequently, to smaller chances of defeating an incoming missile. Glide vehicles may be able to achieve various speeds, altitudes, and ranges, and their

trajectories may vary according to different operational needs reflected in capabilities of a given weapons system.

– The hypersonic missile of the third category is a vehicle which does not follow ballistic trajectory at all. Because of being continuously propelled it is capable to sustain long-distance horizontal flight, so it is called a hypersonic cruise missile (HCM). This kind of weapons would have significant advantages over ballistic missiles or even boost-glide vehicles of comparable ranges and payloads. The most important of them is that such missile is supposed to fly relatively low in comparison to ballistic missiles and even to boost-glide vehicles, which, as we remember, usually have their ballistic phase too. The ultimate variant of an HCM would be a sort of "tomahawk on steroids": a ground-scratching, maneuverable long-range missile, traveling at tree-tops level 6 or 7 times faster than the existing subsonic cruise missiles. There are two main obstacles that must be overcome to perfect a technology necessary to build HCMs of any kind. The first problem, of utmost importance, concerns propulsion. As rocket motors are not applicable, due to their immense fuel consumption, an air-breathing system must be used. It means that a special kind of engine which would be able to work at hypersonic speeds must be constructed - which entails a host of potential technical complications. Furthermore, difficulties in the development of hypersonic air-breathing propulsion amount exponentially if a given engine is to operate within a wide range of velocities and/or at various altitudes. Therefore, hypersonic-powered vehicles currently being tested are accelerated by rocket boosters to the speeds at which they can engage their hypersonic engines. There are also some theoretical concepts of motors which would be more versatile, some purportedly have entered the experimental stage, but they are rather far from becoming capable to be used in combat crafts. Another very important problem of a powered hypersonic missile, which it shares with unpowered ones, is the heat that impacts an airframe as a vehicle moves through the air. Nonetheless, ballistic missiles must withstand it just for seconds, hypersonic gliders start their struggle with atmospheric drag at high altitudes in a relatively thin air – they are supposed to enter the densest layers only seconds before the actual impact. Conversely, hypersonic cruise missiles are exposed to excessive heat during the entire flight – the lower they fly, the stronger this effect is, because an atmospheric drag increases with a velocity squared.

Summarizing technical and operational basics:

– Ballistic missiles are the most common, well-known hypersonic vehicles, based on highly adaptable technology perfected decades ago. They have well-understood characteristics and hold an established place in arsenals of many countries. Therefore, ballistic missiles of various kinds have their share in global and regional power balances. And that is why they are an obvious reference point as long as any other long-range strike system is considered.

– Boost-glide hypersonic weapons, currently under development in Russia, the U.S. and China, do have advantages over ballistic missiles. Shorter warning time and better survivability could add some value to strategic forces of an international actor. They seem particularly suitable to conduct special missions such as attempts to decapitate the enemy's political authorities or surgical, disarming strikes against key civilian or military infrastructure. A HGV's capability to strike in a more surprising way than a ballistic missile can would be useful

in these situations. Nevertheless, a significant change of the strategic balance in favor of those who would field such weapons is not likely to occur for two reasons. Firstly, current and perspective ballistic missiles of various kinds are already extremely accurate and fast, they are also largely invulnerable to the existing missile defenses – a weapon with somewhat augmented capabilities would be useful in many cases but would rather not be critically important for the overall military balance. Secondly, due to their complexity and steep price hypersonic boost-glide systems are not destined to replace current offensive capabilities based on ballistic missiles any time soon.

– Hypersonic cruise missiles would be the real game-changer, the way the currently fielded subsonic ones became in the 1970s when they were introduced into service. However, due to technical difficulties with the development of such missiles, their operational use is a matter of rather distant and vague future. What is more, the first generation of HCMs, when it arrives, will most likely consist of high-flying vehicles. They will surely be a formidable weapon and will contribute to the expansion of offensive capabilities of leading powers, but not as much as it is believed presently. Firstly, the relatively high operational altitude would render them somewhat vulnerable to the defenses – note that we are not talking about a strategic HGV roaming at Ma 20, but about vehicles of much lower speeds. Secondly, the price tag for any HCM will be very high, so they will rather not come to world powers' arsenals in great numbers. And finally, the most dreaded kind of HCM, a combination of powered hyperspeed with capability of the current generation of cruise missiles to fly extremely low, is not going to materialize in the foreseeable future due to technical problems, unless an unexpected technology breakthrough occurs.

The Existing Weapons Systems

Most of the weapons that are usually referred to as hypersonic remain in various stages of prototype development. Some others are even less advanced and represent merely technology demonstration testbeds, some remain just general theoretical concepts. Only a few have been recently declared operational but their real capabilities remain for the most part unknown: firstly, because of the obvious secrecy veil that surrounds military technology, especially the most advanced weaponry; secondly, because deliberate disinformation is being distributed together with politically motivated bragging about alleged achievements of a given nation, its technological prowess, and the power of novel weapons it wields. It is, therefore, rather difficult to assess the real impact of certain weapons systems on the military balance, but we will anyway try to do so, at least in the most general terms.

We will, therefore, discuss several weapons referred to as hypersonic, which either have already been fielded or are being frequently discussed publicly, regardless of their stage of development. We will briefly evaluate these systems and related technologies, pointing to the possible impact of prospective weapons on strategic stability as well. Note that the United States, Russia, and China, presented below, are the most advanced countries in hypersonics, but some other nations have followed suit and invested in similar technologies.

Russia

The first of the weapons advertised by the Russian authorities as a hypersonic missile is the "Kinzhal". Officially it has been introduced into operational service in 2018, as a hyperspeed rocket system (гиперзвуковой ракетный комплекс). It consists of a specially equipped variant of a long-range fighter MiG-31K as a carrier-launcher, and a missile H-47M2 „Kinzhal" (X-47M2 "Кинжал"). The first unit which received this weapon was the 21st Guards Mixed Air Division (21-я гвардейская смешанная авиационная дивизия), belonging to the 14th Air and Air Defence Forces Army(14-я армия военно-воздушных сил и противовоздушной обороны) of the Russian Aerospace Force (Воздушно-космические силы Российской Федерации). This unit is currently at the disposal of the Central Military District and stations near Chelyabinsk in central Russia. There is also an information that long-range bombers Tu-22M3 are also to be adapted to carry the "Kinzhals", but so far they have not been deployed in this capacity.

By definition the "Kinzhal" is a hyperspeed missile since it is capable of reaching the velocity of Ma 5+. But it is neither a cruise missile, as it is propelled by a rocket motor, nor a boost-glide vehicle, due to its shape and trajectory it employs. In fact, as it is plainly visible at released pictures and videos, the "Kinzahl" is an air-launched variant of a short-range ballistic missile (SRBM) 9K-720 "Iskander" (U.S. DoD designation SS-26, NATO reporting name "Stone"), in service since 2006. It is indeed a formidable weapon, believed to be maneuverable and accurate, but it is still a ballistic missile. Therefore, the "Kinzhal" is also a formidable weapon, with a range of some 2000 km, but still it is a ballistic missile. Its introduction into service certainly contributed to the overall warfighting potential of the Russian armed forces. But this weapon's capabilities are not entirely unique, as Russians already possess air-launched cruise missiles which are able to conduct highly precise strikes at comparable distances and beyond, and are also extremely difficult to counter. So, the "Kinzahl", by all means, augments the Russian offensive capabilities against sensitive targets but brings nothing essentially new with respect to that. It is supposed to be particularly capable of overcoming missile defenses, and so it is for sure. But ballistic missile defenses in the world, both current ones and those under development, are and will remain unable to withstand an offensive of the Russian ballistic and cruise missile forces even without "Kinzhals". All in all, it is a powerful weapon, a valuable addition to the Russian arsenal, but definitely it is not a game-changer.

Another hypersonic weapons system which Russia boasts is the "Avangard". Contrary to the "Kinzhal", it is truly a novel technology, a boost-glide intercontinental range vehicle. It has been flight- tested several times and, according to President Putin, is supposed to enter service in 2019. The system uses UR-100NUTTH ICBM (SS-19, "Stiletto") as a booster, atop of which a single glider is installed. The exact technical characteristics, especially what trajectories it can follow, are not known publicly. Notably, it is not known whether the "Avangard" is capable to "bounce off" the atmosphere after the initial re-entry and then re-enters again following a phase of the ballistic suborbital flight, or once it is back in the dense air it only glides through it. The former flight pattern, if employed, would add even more to its capability to conduct a long-distance strike from below the radar horizon of targeted objects.

In any case, the "Avangard" represents a powerful weapon of an intercontinental range, especially suitable to conduct surprise attacks against high-value targets.

According to the available sources, in 2019 two pieces of UR-100/Avangard will be deployed in silos of the Dambarovsky missile base, located in the Orenburg Oblast in central Russia. Gradually, the number of systems is to increase aiming to form a regiment consisting of six units. The second regiment is supposed to be deployed, according to the same sources, by 2027.

As we have already noticed, the "Avangard" is certainly a valuable addition to the Russian deterrence capability. But given the fact that the strategic balance is being supported by hundreds of strategic delivery vehicles with well over a thousand of deployed warheads, a dozen more do not change it significantly. It is often stressed that the "Avangard" has the superior capability to overcome missile defense systems. But it is rather irrelevant because modern delivery systems other than hypersonic, together with those under development, are also mostly undefeatable. Plainly speaking, ballistic missiles with swarms of decoys and other penetration aids, employing multiple defense evasion or saturation attack patterns are unstoppable with today's anti-missile weapons. And this is not likely to change in foreseeable future, as we often maintain. Thus, the "Avangard" does not make any important difference in the strategic balance, especially given its limited procurement rate.

China

When it comes to the assessment of the Middle Kingdom's military capabilities, we encounter obvious and well-known information noise that is surrounding all China's high-tech weapons programs. It is therefore very difficult to ascertain exactly which capabilities the Chinese have already perfected and which they are just pursuing. Nonetheless, it is rather certain that they have been developing both HGV and HCM, although details are unknown, despite a lot of information available. It is, however, mostly a buzz in the blogosphere, heavily impacted by deliberate disinformation. Below we will briefly summarize the most plausible evidence referring to the Chinese hypersonics.

First of all, the boost-glide system has been developed in China for some time, several tests were conducted in recent years. This weapon is the most commonly referred to as "Dong Feng 17" (DF-17), and most probably represents an HGV of a medium range, up to 2500 km. It is rather confirmed that China nears the threshold of operational capability of the system, the U.S. intelligence expects it to enter service in 2020, although the purpose of this weapon is not clear. Especially it is not known if it is supposed to be able to attack moving targets like aircraft carriers, or only fixed ones.

China is also believed to be working on the development of an HCM which is dubbed the "Starry Sky 2" ("Xing-Kong – 2") – it purportedly reached the velocity of Ma 5,5 at the altitude of 30 km during the test in 2018. It is, however, unknown if this vehicle is only a technology proving craft, or already a missile prototype – most probably it is the former. So, the Chinese HCM is, in essence, an advanced technology demonstrator comparable

to the American X-43A unmanned testbed which reached Ma 9,6 at the altitude of 33,5 km in 2004.

The development of hypersonic weapons brings the Chinese a greater chance to shift the strategic balance in their favor than it does to the Russians. A more detailed argument that follows is rather theoretical and based on assumed capabilities of the current and prospective Chinese weapons systems. Even so, it is to our belief worth making some guesstimates.

Therefore, two important dimensions should be taken into consideration:

Firstly, the Chinese strategic deterrent forces are much smaller than the American ones. That is why, if China decides to pursue an intercontinental variant of its HGV, it would matter more than a handful of novel weapons in the vast Russian arsenal. It is currently not known if the Chinese are actually working on such a weapon, but it seems probable because they do consider their strategic arsenal of less than 100 delivery systems capable to hit the U.S. inadequate. It is widely feared in China that the expansion of long-range precision strike capabilities undertaken under the American concept of Air-Sea Battle, plus the U.S. missile defense, which is capable to defeat at least some of the mostly obsolete Chinese missiles, may render the existing Chinese ICBM/SLBM force useless. Therefore, China is poised to modernize and expand its strategic deterrent forces, and an addition of the hypersonic weapons with their superior penetration capabilities would greatly help ensure the balance of the mutually assured destruction potentials between the U.S. and China.

Secondly, China is also currently expanding the capabilities to secure its mainland from a conventional strike of the U.S. forces deployed in the bases around China and on the adjacent seas. It is called "A2/AD strategy" and is designed to deny the enemy the use of staging areas for such strikes by limiting freedom of operation of the U.S. Navy and by placing the U.S. military installations around China under the threat of a crippling attack. Hypersonic gliders and HCMs, even in limited quantities, may become valuable assets within this strategy, especially at greater distances. This is especially important because the United States is developing their Ballistic Missile Defense System (BMDS) mostly to counter Chinese ballistic missiles for they are one of the key prerequisites for the execution of the "A2/AD" strategy. Even if the current capabilities of the BMDS are questionable, their sheer size adds uncertainty to the Chinese offensive defense strategy, and thereby even a limited quantity of high penetration weapons may become significant.

Summarizing the value of hypersonic weapons for China, we point at two overlapping issues. On the strategic level, hypersonic weapons may somehow contribute to the ensuring of the strategic balance with the U.S. in terms of nuclear deterrence, but it is actually not critically important for that purpose. Since China has been developing the new generation ICBM, the "Dong Feng 41" (DF-41), which is supposed to be a road-mobile modern missile armed with multiple warheads, and is rapidly expanding its submarine strategic force, the U.S. territory will remain endangered by the Chinese second strike even without hypersonic weapons. Secondly, the medium range HGVs or the prospective HCMs will have an impact on the regional balance which is poised to shift in favor of the Chinese. Nevertheless,

it is inevitable even without hypersonic weapons. The Chinese capabilities critical for the "A2/AD" strategy, such as satellite ISR systems, over-the-horizon (OTH) radars, long-range ballistic and cruise missiles as well as attack submarines, have matured anyway. All in all, the hypersonic weapons are no game-changer by themselves, they are a part of the comprehensive effort undertaken by China for a long time now.

The United States

The U.S. has got by far the greatest knowledge about hypersonics. It started thinking about vehicles capable to glide from the orbit with hypersonic speed as early as in the late 1950s. The first relatively mature concept was the X-20 "Dyna-Soar" spaceplane, abandoned in 1963. In the 1980s the Space Transportation System, better known as the Space Shuttle, was introduced. It was nothing less than a huge hypersonic gliding vehicle, which flew 133 successful missions during 30 years of service and was terminated in 2011. The Americans were also first to start flight-testing scramjet (supersonic ramjet) engines by 2001 during the "Hyper-X" program conducted by NASA. However, it was a scientific endeavor, aiming at a basic research on hypersonic powered flight, not a weapons development program. The U.S. felt no urgency with the development of hypersonic weapons, the military budget was strained by more pressing issues like foreign engagements and other vast armament projects.

Currently, we can observe the rapid growth of the budget expenditures related to the development of the actual hypersonic weapons. There are several programs of that sort in various stages of development, representing both HGV and HCM. Given the amount of knowledge, the technological skills of leading aerospace manufacturers and massive funds allocated there, we may expect first hypersonic weapons of the boost-glide type to enter service in the U.S. armed forces within several years. We may also expect HGVs to be produced in relatively large quantities, so the American arsenals will most likely grow fast. HCMs will probably follow within a decade.

AGM-183A ARRW (Air-Launched Rapid Response Weapon, sometimes dubbed "Arrow") is a weapons system presumably nearing combat readiness. It is supposed to materialize as early as 2021. It is developed by Lockheed Martin and generously funded by the U.S. Air Force at USD 480 mln in the initial contract, which is likely to increase to 780 mln through 2023. The characteristics of this weapon are unknown, except that it is believed to be based on DARPA's Tactical Boost Glide (TBG) concept which will undergo first tests in 2019. Some sources suggest that ARRW will have a velocity of MA 20 – if so, it would be a long-range, probably even an intercontinental weapon.

The second project, awarded to Lockheed Martin as well, is the Hypersonic Conventional Strike Weapon (HCSW), not given a military designation yet, currently funded with USD 928 mln. According to the available information, it is supposed to be a shorter range rocket-boosted glider exceeding Ma 5 and launched from tactical and strategic warplanes. Its early operational capability is scheduled for 2022. It is believed to be a somewhat simpler weapon, basing on mature technologies, therefore its early development and high production rate are more likely than those of the highly sophisticated ARRW.

Both programs appear to be in the crash mode, with an obvious intention to bring hypersonic capabilities as quickly as possible and to match similar developments of China and Russia. But there is also an HCM program considered as the most promising, but surely more demanding, and therefore it is at an early stage of its development, not yet scheduled for the operational use. Even the name of the programme, Hypersonic Air-breathing Weapon Concept (HAWC), suggests its relatively unadvanced state. It is conducted by Lockheed and Raytheon partnered with DARPA.

The U.S. has also implemented some other programs related to hypersonics which for now have had a form of basic studies, such as, for example, U.S. Navy's Intermediate Range Conventional Prompt Strike. Additional research efforts funded by the Pentagon are supposed to receive more than doubled funding in 2019, compared to previous years.

Conclusions

The most general observations which refer to the characteristics of technology involved and operational realities of the hypersonic warfare are as follows:

1. Hypersonic weapons systems which are currently being fielded or are about to materialize in the nearest future are solely the variants of boost-glide technology. They differ in range and other important parameters, but they are basically alike. Therefore, this is currently the only class of hypervelocity weapons which should be considered in terms of their impact on international security.

2. The HGVs are indeed more difficult to counter and it makes them more effective than currently used ballistic missiles to which they may be compared. Note that low-flying cruise missiles are different and they present other unique capabilities – incomparable to HGVs or ballistic missiles.

3. The deployment of HGVs will probably not change military strategy in the foreseeable future because modern types of well-known and much cheaper ballistic missiles, together with low-flying cruise missiles, are also extremely difficult to counter. Therefore, hypersonic gliders' capabilities cannot be considered entirely new and absolutely unique, they only augment the existing potential, but not so much.

4. Consistently, the limited quantities of the combat-ready HGVs which China and Russia will possess in the coming years will neither significantly shift a strategic balance nor make changes in regional power equations. If the latter change in favor of China it will be an effect of much wider developments in which hypersonic weapons play only a part.

5. The high-flying HCMs of the first generation will not enter service in the nearest future, we assess that it might happen no earlier than in the second half of the next decade. Thus, it is now premature to consider seriously their impact on the strategic balance. The ultimate, low-flying HCMs are even much further away in the future, as their technological feasibility is debatable in itself.

If we consider international security as a whole, two issues deserve attention with regard to stability of the global power balance related to the advent of hypersonic weapons.

1. It is widely believed that the deployment of the hypervelocity attack systems will contribute to the strategic destabilization, because of their ability to shorten the target's reaction time. Therefore, as the narrative goes, a nation which wields even limited quantities of the HGVs might be tempted to venture on some kind of decapitating or debilitating strike against a perceived adversary, hence purported destabilization. This common argument is true but only to an extent. It is because hypersonic weapons do not spawn the capability to conduct such a strike, it already exists. A decapitating or disarming offensive may, in theory, be attempted with the use of existing technologies or their easily achievable derivatives such as conventional low-flying cruise missiles, SLBMs fired at short to medium distances at depressed trajectories, or prospective superfast medium-range ballistic missiles with maneuverable warheads. Admittedly, the hypersonic weapons may be somewhat more effective to execute such an attack, but the difference is not big enough to significantly reduce the risk involved. Plainly speaking, such undertaking, although somewhat more likely to succeed with the use of hypersonic weapons than with conventional ones, would still remain essentially as risky and tricky as before. Only low-flying HCMs might, in theory, significantly change the situation, but it is still premature to take this into consideration. We may, therefore, reiterate that the technically feasible hypersonic weapons, which have already been or are about to be fielded, will surely be a valuable addition to the potential of strategic destabilization in the relations between all the three leading military powers we have mentioned in above, but they cannot make a game-changing difference.

2. Another destabilization effect which is more likely to follow the full-blown development of hypersonic weapons will most probably come from the other, less frequently mentioned, direction. Given amassed knowledge and generous funding, we may expect that the United States will deploy hypersonic weapons relatively soon and in significant quantities. It will not augment substantially the already profound U.S. military advantage, but will surely be politically momentous and will invoke counteractions from the competitors, both in kind and asymmetric. It will add to global tensions, emotions, uncertainties, and suspicions among the global military powers. It will contribute greatly to the general arms race with all its destabilizing potential.

Hence, if the hypersonic weapons do not bring any significant changes in the military balance by themselves, why are they so eagerly funded and so zealously pursued by the three world powers? Simply speaking, why so much buzz is about that kind of armaments, especially in the West? To answer this question, let us consider related political issues regarding all the three countries separately.

Russia

For the Russian Federation, it is very important to be a world-class power, as its political identity is to a great extent based on the assumption that Russia is destined for greatness. Globally significant military might is also believed to be necessary from the national security perspective. However, Russia is actually fading as a world-class power, for it is unable

to sustain its own economic, social and technological development. Nevertheless, it is still pretending to be the one. Strategic relations are in fact the last field where Russia might interact with the U.S. on a relatively equal basis. This purported parity with the United States is actually the last attribute of Russia's greatness. It is one of the main reasons why the military dimension of Russo-American relations is so much stressed by Moscow. Displaying the warfighting capabilities by participation in actual conflicts, conducting military provocations, and advertising highly advanced weapons is a part of this strategy destined to use to the greatest extent the last trait of a superpower that Russia possesses. And here come hypersonic weapons, heavily promoted to the internal and international public as the invincible unmatched technology "made in Russia".

In more practical terms, the novel weapons may also become an important bargaining chip in the coming future, especially since the U.S. withdrew from the INF Treaty. This development is potentially very dangerous for Russians, as it may quickly bring to existence a range of the new American sophisticated weapons – hypersonic ones among them – which in theory would augment the capabilities to decapitate Russia or disarm its strategic deterrent. The arms control process seems already dead and will rather not resurrect any time soon, but finally, after another leg of the arms race, the parties will most likely come to the table, probably with China as an equal partner. The well-developed hypersonic weapons, even without profound military significance, may play some part in this political process.

China

As for China, the hypersonic weapons are important from the strategic point of view in the first place, as we have argued above. However, we have to remember that their development should be understood rather as an important part of the overall effort, not as something separate with totally unique game-changing capabilities. Hence, the PRC is augmenting its military potential on the global and regional scale and is gearing to take a more prominent position in the world. The hypersonics play a role in this process, but it also consists of a wide range of other capabilities: satellite ISR, cyberwarfare, nuclear rearmament, and – last but not least – technical modifications of conventional sea, air, and land forces accompanied by the fast developing doctrine of the use of the military in combat as well as for the political purposes. Thus, again, the hypersonic weapons are important, but just as a part of the process and by no means are a critical element of it.

Nevertheless, another dimension of the development of the hypersonics in China, the political one, must be highlighted . It is generally understood that in modern times technological development is what shapes the world to the greatest extent. Therefore, a nation which has an aspiration for global superpower status must also assume leadership in science and technology. Hence, the development of the hypersonics, like in the case of other state-of-the-art weapons systems and the most advanced technologies, is an important part of the overall Chinese development program. Moreover, it is the field of research where China seems, at least according to the news, to lead the world, allegedly surpassing America. This is a critically important opportunity to prove that the Middle Kingdom has already emerged as a significant competitor to the U.S. in this sophisticated field. Pioneering, or at least looking

like doing so, in the novel weapons development is therefore very useful as a clear sign of the Chinese technological prowess which is a part of its overall power contributing to the rise of China's position in the world.

All in all, for China the development of the hypersonics is not only a military issue but also the matter of political prestige and a valuable argument for a high international status of the country. This is critically important because China as a contender must constantly prove its claims of parity with the other superpowers, especially the U.S.

The United States

As the Chinese and the Russians boast of novel technologies, claiming that they have surpassed the famed American high-tech, the U.S. politicians, military experts, and political commentators eagerly take up this narrative. Thus a demand to step up funding and development of own American hypersonic weapons which allegedly are far behind Chinese or Russians mount steadily. This is, however, a political alternative reality, we apparently witness the creation the new "hypersonic gap", similar to the previous "bomber gap" or "missile gap" perceived in the 1950s. In fact, the Chinese and Russians are neither overtaking the U.S. significantly nor they are anywhere close to deploying militarily significant numbers of gliding maneuverable warheads for their long-range ballistic missiles. What is more, there would be no change in the effectiveness of the missile defense in the event that such systems are deployed, because – let us reiterate – it is already ineffective against sophisticated ballistic missiles with advanced penetration aids, and it will the most likely remain so for the time being.

But the allegations of backwardness of the U.S. has their deeper political purposes, related to internal politics and vested economic interests. First of all, the "hypersonic gap" provides politicians of all denominations with a powerful tool to assert themselves on the internal political market. It is a well-known mechanism of inflating external threat in order to show politicians' purported decisiveness, strength, and abilities to lead. It usually gives opportunity to easily score points in political struggle, and so everyone tries to catch up with it. This mechanism intertwines with the interest of powerful industrial circles, interrelated with politics through well-established, well-known channels. The development and procurement of the novel expensive weapons give the industry a chance for increased profits and create workplaces for the constituency. This will most probably happen with the hypersonic weapons as the new field of industrial expansion, making therefore so many people and companies are interested in promoting it.

And, finally, the United States is compelled to develop the newest weapons to help uphold its global leadership. Until recently the Americans have not felt any urgency to develop hypersonic weapons, because no-one in the world professed this technology. But as the fielding of the newest systems by the adversaries is about to happen or actually have happened, the U.S. must follow suit, to prove their leading position in the world. It is a relatively simple and obvious political mechanism.

The Final Assessment

We do not negate the superiority of the novel weapons in terms of technical and operational capabilities. Putting aside obviously false presentations, like the one that depicts the "Avangard" rather as an HCM not HGV, they are surely impressive. But if we take a look at the big picture we notice that technical capabilities do not stand alone for the usefulness of certain weapons systems and for their real significance. Every weapon is a part of the wider military and political effort and should be considered within proper contexts, both strategic and security related ones.

Therefore, our main argument is that the multi-faceted political role of the hypersonic weapons is more important as a driver of their development than much hyped strategic or operational needs based on their real or purported characteristics. As we have shown, all the three global powers embrace many internal and international political goals and aims for their strategies of development of the hypersonics.

Last but not least, from a point of view of the United States the most important is not building hypersonic weapons but rather augmenting the defenses against them. It is, of course, a very difficult task itself, but not impossible one, especially given the U.S. knowledge of hypersonics and technological experience of the leading manufacturers. And this is exactly what the Americans are doing, both in terms of advocating for the development of related sensor technologies but also with regard to interception methods. There is a wide range of concepts being studied, from infrared detectors mounted on various platforms to spot and track superheated hypersonic objects, to upgrades of the existing and future radars to detect hot plasma generated by the hypersonic flow. There are also several concepts of defeating the HGVs, which range from the "left of launch" counteraction, through electronic warfare to the actual destruction of the coming missiles. With regard to the latter, DARPA is scheduled to test its Glide Breaker interceptor concept as early as 2020. These developments will have the potential to off-set the enemies' development and prevent balance from shifting, as well. Thus, we must stress, the counter-hypersonics should be as thoroughly observed and considered as the development of hypersonic weapons systems itself.