

Will the Hypersonic Arms Race be our Ruin?

By Calum Browne

Even though the Cold War ended three decades ago¹, the 'West' and 'East' have continued to compete in the development of weapons technology. Long after the USSR collapsed, the competition between the US and Russia continues to ramp up, exasperated by the rise of China as a Pacific powerhouse. For the first time since the nuclear scare, the next devastating new weaponry is being developed, designed to travel at 27 times the speed of sound.² These new instruments of war are known as Hypersonic Weapons, or 'hypersonics' and while they cannot yet carry nuclear warheads, ultimately, this is the aim. So, what are these 'hypersonics'? Why are they different from conventional weapons? And what does the rise of this technology potentially mean for you and me?

What Are 'Hypersonics'?

Hypersonic is used here as a noun, a great pet peeve of Thomas Karako³ an expert on missile defence. The term refers to the trajectory and, maybe most importantly, the endo-atmospheric characteristics of these devices. The main two devices that security officials are concerned with are Hypersonic Glide Vehicles (HGVs) and incredibly fast Cruise Missiles.

Hypersonic missiles have long been the dream of militaries⁴, but only now is the infrastructure and the technology advanced enough to be making the necessary strides forward. As with many cutting-edge technologies, militaries around the globe are hoping to add hypersonic weapons to their arsenals, but only Russia, China, and the US appear to be close to the finish line. Most recently, Russia claimed in October 2020 to have successfully launched a hypersonic cruise missile, hitting a target in the Barents Sea.⁵ Whilst such claims should be greeted with a level of scepticism, the development of these weapons is extremely worrying.

Why Are Hypersonics Different?

¹ The Cold War Period is generally thought to be the period from the implementation of the *Truman Doctrine* in 1947 to the dissolution of the USSR in 1991.

² Staff Writers 'Avangard Hypersonic Glide Vehicle Devs Patent New Rocket Refuelling Tech' *Space Daily* (29th January 2019)

³ Thomas Karako is a Senior Fellow at the International Security Program and Director of the Missile Defence Project at the Centre for Strategic and International Studies (CSIS)

⁴ The first air vehicle to achieve hypersonic speeds was launched in 1949. 'Hypersonic Flight' *Smithsonian: National Air and Space Museum*, accessed 04/12/2020 <<https://airandspace.si.edu/stories/editorial/hypersonic-flight>>

⁵ Associated Press, 'Russia Reports Successful Launch of Hypersonic Missile' *DefenseNews* (7th October 2020)

Hypersonic weapons are markedly different from other types of missiles. Previously there have been two main 'flight profiles'⁶ for missiles: Ballistic and Cruise missiles. Ballistic missiles have been the priority for US missile defence and research for decades, and the US are far and above the world leaders in the field. Ballistic missiles launch at a steep, high arch up into the atmosphere and then, after reaching the highest point of their ascent, they come back down and eventually enter, what is known as, the terminal phase and hit their target at supersonic or hypersonic speed. Cruise missiles on the other hand travel at much lower altitudes, the most famous being the Hellfire missiles group that the US military often deploys in its Middle East exploits.

The problem that hypersonics pose is that because US strategy has been so heavily orientated towards Ballistic missiles and defending against them, the US is ill prepared to combat these newer, faster, and much lower altitude weapons. Since the US has focussed on Ballistic capabilities, countries like China⁷ and Russia⁸ have spent this time researching weaponry that can pierce the iron-clad Ballistic defences that the US, and most of the Western world, use.

What is the Problem?

Hypersonic weapons are different due to three main characteristics: altitude; speed and manoeuvrability. These three things pose an array of problems, particularly on the defensive end regarding Tactical Warnings and Attack Assessments.

The US employs what is known as an Anti-Access/Area Denial (A2/AD) defence system. The best way to think of this is a huge bubble of radars and satellites that cover most, if not all, of the globe. Now take the darling of US missile technology, a Ballistic missile. When a missile launches (or the boost phase), it is picked up by a huge array of infrared satellites that let the US know, frequently through North American Aerospace Defence Command (NORAD) systems, that a launch has taken place. When a Ballistic missile gets too high to be picked up by the infrared satellite system, then another radar system is used to track the missile's course. Not only does this allow a missile to be tracked from launch to target, but it also acts as a two-step authentication process. As with all technology, occasionally it goes awry, and an infrared error may be picked up that suggests a missile launch. However, if that supposed launch is then not confirmed later by the radar system, then it is clear that it is a false positive. This avoids not only unwarranted panic and retaliation, but ensures that the President of the United States, and their commanders are working with the best and most up-to-date information possible.

Now, take Hypersonic Glide Vehicles. These missiles will have a boost phase that will show up on the infrared satellite system. However, that only gives officials one side of the story and does not negate the possibility of a false positive. The real problem lies in the radar detection. The radar system is designed to detect missiles that launch to a certain altitude. HGV's are specifically designed to fly to an altitude that is high enough to not be detected by lower altitude radar systems, but low enough to not be picked up on the high-altitude system either. This means that precise detection will not happen until much closer to the terminal phase, making Tactical Warning incredibly difficult. Whilst

⁶ Hudson Institute 'China's Hypersonic Missiles Advances and U.S. Defense Response' (11th March 2019), accessed 02/12/2020 <https://www.youtube.com/watch?v=trCTKvAqXz0&ab_channel=HudsonInstitute>

⁷ The Chinese have developed prototypes of a HGV called the *DF-17*, and show cased it in several military parades, accessed 03/12/2020 <<https://missilethreat.csis.org/missile/df-17/>>

⁸ The Russian military have a Hypersonic Cruise Missile known as the *Zircon*, which was launched in the Barents Sea (refer to footnote 2).

that still leaves defence systems some time to work with, the next problems become the speed and manoeuvrability of the HGV.

These missiles will travel at a minimum of 5 times the speed of sound, so if one is “fired by the U.S. submarines or bombers stationed at Guam, [it] could in theory hit China’s important inland missile bases, like Delingha, in less than 15 minutes”.⁹ The weaponry being prototyped by the US would travel “between Mach 15 and Mach 20”¹⁰, not allowing defence systems much time to respond, and without two-step authentication, officials will not be fully sure they are even witnessing a launch. The sheer speed of the missile also poses interception problems. Missile interceptors cannot travel that quickly currently, and in order to intercept an HGV before it becomes terminal, an interceptor would need to be travelling at least as fast if not faster than the HGV.

Unlike a traditional Ballistic or Cruise missile, HGV’s can also be manoeuvred during flight. The fact that HGVs can manoeuvre make it incredibly hard to target, meaning that interceptors need a much longer range to catch these HGVs when they change course. Manoeuvrability also creates problems for attack assessment. As previously mentioned, Ballistic missiles have a very similar trajectory each time, meaning that relatively accurate attack assessments can be made. HGV launches, however, are not easily anticipated. A HGV strike could land in several different places. The fallout from an attack would not be as drastic as “will it hit Oregon or D.C.?”¹¹, but could potentially be: “will it hit Oregon or Washington State?”¹²

It can be easy to take all this information and just conclude that until the US, or other Western democracies, catch up, Russia and China are beginning to inch ahead. However, the reality is these situations are incredibly fluid. What is impossible this minute may be possible the next. Military technology moves at a neck-breaking speed and new innovations are being thought up constantly. The next step in this new arms race is cracking the code on hypersonic boosters and formulating a new defence system.

The defence system that experts seem to be favouring is a Space Sensor Layer. This would effectively place “hundreds of satellites in low earth orbit (LEO) to track hostile hypersonic missiles”.¹³ This would focus on weaponry launched at the altitude that hypersonics travel at, returning to that all important two-step authentication process. Still, this sort of system takes money, time and the military industrial base has to be up to the task. The U.S has state of the art testing facilities, but reports suggest that China has wind tunnels that can test around Mach 10, with the US topping out at Mach 5 testing.¹⁴ However, in a show of strength and confidence in the process, \$120.4 million was invested in a new sensor layer under the NDAA.¹⁵

⁹ R. Jeffrey Smith, ‘Hypersonic Missiles are Unstoppable. And They’re Starting a New Global Arms Race’ *New York Times* (19th June 2029)

¹⁰ *Ibid*

¹¹ Hudson Institute ‘*China’s Hypersonic Missiles Advances and U.S. Defense Response*’ (11th March 2019), accessed 02/12/2020 <https://www.youtube.com/watch?v=trCTKvAqXz0&ab_channel=HudsonInstitute>

¹² *Ibid*

¹³ Loren Thompson ‘To Defeat Hypersonic Weapons, Pentagon Aims To Build Vast Space Sensor Layer’ *Forbes* (4th February 2020)

¹⁴ Hudson Institute ‘*China’s Hypersonic Missiles Advances and U.S. Defense Response*’ (11th March 2019), accessed 02/12/2020 <https://www.youtube.com/watch?v=trCTKvAqXz0&ab_channel=HudsonInstitute>

¹⁵ ‘Hypersonic Weapons: A Challenge and Opportunity for Strategic Arms Control’ *United Nations Office for Disarmament Affairs and United Nations Institute for Disarmament Research* (2019)

Thomas Karako¹⁶ put it best when he said that this isn't about inevitable conflict, this is about keeping up with other countries, because if the US falls too far behind then someone like China can win a war without firing a single shot. As China continues to pull ahead in the world economy, US power in the Pacific becomes less stable. If the US wants to continue to be a competitive Pacific power, as well as reign in Chinese operations in the region, then their missile capabilities must keep pace with China.

These developments will, at least for the foreseeable future, have little impact on our day-to-day life in a Western democracy such as the UK. The reality is that such weapons tend to become part of the ever present, but never used, nuclear arsenal that many of the more powerful countries hold in their back pocket. The UK alone has approximately 120 nuclear devices¹⁷ and is working alongside the US to ensure it is not left far behind in the hypersonic race.¹⁸

As part of this arms race we are also witnessing cutthroat espionage. On the 4th December 2020, for example, a Russian hypersonic expert was arrested and charged with high treason, accused of handing "over secret aviation development data abroad".¹⁹ This arms race may be bloodless for now, but that may not continue to be the case.

What This All Means

The reality is that the immediate effect of these weapons will be felt where missile strikes are already a part of everyday life. Take the Middle East, where the US have been fielding testing the 'Ninja Bomb'²⁰²¹, which uses kinetic energy to crush targets under around 100 pounds of force and deploys steel blades at the last second to slice and carve up targets without the need for a single explosion. Add a hypersonic boost engine to such a missile and targeted individual killings or mass killings can be carried out in a matter of minutes from thousands of miles away. The Middle East has become a 3 million square mile weapons testing facility for modern militaries, and it is not beyond the pail to believe that hypersonics will get live fire testing in the most volatile regions.

Like most of the technology that is created by the well-funded and the most powerful, it is the individuals in countries like Syria, Afghanistan, and Yemen who will ultimately pay the price, while for many, war will remain a distant concept. We live our lives far from the sound of gunfire and the human cost of war, and we ignore it. Ignorance, however, is a privilege that people in war torn regions cannot afford.

The military industrial complex will continue to make billions from these weapons, and the countries in which they are designed will most likely remain untouched, as they so often do. It will be in the tug

¹⁶ Hudson Institute 'China's Hypersonic Missiles Advances and U.S. Defense Response' (11th March 2019), accessed 02/12/2020 <https://www.youtube.com/watch?v=trCTKvAqXz0&ab_channel=HudsonInstitute>

¹⁷ 'Fact Sheet: The United Kingdom's Nuclear Arsenal' *Centre for Arms Control and Non-Proliferation* (22nd April 2020)

¹⁸ 'UK/U.S. Thresher Project Points To Britain's New Hypersonic Push' *Aviation Week Network* (1st April 2020)

¹⁹ David Brennan 'Russia Arrests Hypersonic Aircraft Expert on High Treason Charges' *Newsweek* (4th December 2020)

²⁰ Also known as the AGM-114R9X or *Hellfire R9X*.

²¹ J.D Simkins 'Photos show devastation unleashed on terror leaders by sword-carrying 'Ninja bomb' *Military Times* (20th June 2020)

of war that has engulfed the Middle East for decades where these weapons will be deployed. Until the public conscience turns against the use of our tax money to develop these weapons they will further devastate the families and children of far-off wars.

Home and abroad, COVID-19 is ravaging economies. Medical infrastructure has been pushed to its breaking point. As the NHS continues to struggle during the effects of COVID, Boris Johnson has promised a £16 billion rise in defence spending²², as people are dying in underfunded hospitals. Public discontent is a powerful tool and has only become more important in a time where the government seems less and less concerned with public opinion. As John Kerry once said “[...] patriotism includes protest, not just military service”.²³

²² Dan Sabbagh & Patrick Butler ‘Boris Johnson agrees £16bn rise in defence spending’ *The Guardian* (18th November 2020)

²³ ‘Vietnam Veterans Against the War Statement by John Kerry to the Senate Committee of Foreign Relations’ *The Sixties Project* (23rd April 1971) accessed 07/12/2020 <http://www2.iath.virginia.edu/sixties/HTML_docs/Resources/Primary/Manifestos/VVAW_Kerry_Senate.html>

Bibliography:

Reports:

- 'Hypersonic Weapons: A Challenge and Opportunity for Strategic Arms Control' *United Nations Office for Disarmament Affairs and United Nations Institute for Disarmament Research* (2019).

News Articles:

- Staff Writers 'Avangard Hypersonic Glide Vehicle Devs Patent New Rocket Refuelling Tech' *Space Daily* (29th January 2019).
- Associated Press, 'Russia Reports Successful Launch of Hypersonic Missile' *DefenseNews* (7th October 2020).
- R. Jeffrey Smith, 'Hypersonic Missiles are Unstoppable. And They're Starting a New Global Arms Race' *New York Times* (19th June 2020).
- Loren Thompson 'To Defeat Hypersonic Weapons, Pentagon Aims To Build Vast Space Sensor Layer' *Forbes* (4th February 2020).
- 'Fact Sheet: The United Kingdom's Nuclear Arsenal' *Centre for Arms Control and Non-Proliferation* (22nd April 2020).
- 'UK/U.S. Thresher Project Points To Britain's New Hypersonic Push' *Aviation Week Network* (1st April 2020).
- David Brennan 'Russia Arrests Hypersonic Aircraft Expert on High Treason Charges' *Newsweek* (4th December 2020).
- J.D Simkins 'Photos show devastation unleashed on terror leaders by sword-carrying 'Ninja bomb'' *Military Times* (20th June 2020).
- Dan Sabbagh & Patrick Butler 'Boris Johnson agrees £16bn rise in defence spending' *The Guardian* (18th November 2020).

Websites:

- 'Hypersonic Flight' *Smithsonian: National Air and Space Museum*, accessed 04/12/2020 <<https://airandspace.si.edu/stories/editorial/hypersonic-flight>>
- 'Vietnam Veterans Against the War Statement by John Kerry to the Senate Committee of Foreign Relations' *The Sixties Project* (23rd April 1971) <http://www2.iath.virginia.edu/sixties/HTML_docs/Resources/Primary/Manifestos/VVAW_Kerry_Senate.html>
- *Missile Threat: CSIS Missile Defence Project* <<https://missilethreat.csis.org/missile/df-17/>>

Videos:

- Hudson Institute 'China's Hypersonic Missiles Advances and U.S. Defense Response' (11th March 2019) <https://www.youtube.com/watch?v=trCTKvAqXz0&ab_channel=HudsonInstitute>