



ZIRCON: THE RUSSIAN HYPERSONIC CRUISE MISSILE

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Hypersonic weapons or missiles are being developed in select countries for the last few years. These missiles have the capability to attain speeds five to six times the speed of sound (Mach 5 to 6 or beyond) thereby multiplying its destructive power due to the increased kinetic energy. Besides giving reduced reaction time, this kind of destructive power is ideally suited against hardened or heavily armoured enemy's shelters /defences/ nuclear posts or modern warships. At present, USA, China, Russia and India are all pursuing development and production of hypersonic missiles which can easily beat the adversary's air defence systems.

In designing these vehicles, generally two types of technologies are used to achieve hypersonic speeds. The first method involves a weapon/warhead carried on a rocket in to space which re-enters the earth's atmosphere followed by high speed glide to the target. The second technique uses scramjet engine to achieve high speeds. In a scramjet engine, by allowing the combustion of hot gases to occur in a supersonic

airflow, hypersonic speeds beyond Mach 4 can be achieved. It must be appreciated that by increasing the missile's speed to Mach 6 (say) the destructive power of the weapon will increase exponentially to 36 times to that experienced at speed of Mach 1.¹The challenges, of finding the ideal propulsion system and appropriate materials to protect the hypersonic air vehicle against the extreme temperatures and shock waves experienced during high speeds flights, have kept the developers away from making any big claims about their induction into the armed forces.

It was rather unexpected and a big surprise when the Russian News Agency TASS reported on 19 April 2016 that the Russian Navy will have its first hypersonic cruise missile by the year 2018². In fact, test firings of this missile called Tsirkon (Zircon) have already begun and the serial production is expected to start by 2018, four years ahead of their planned target year of 2022. The Zircon hypersonic missile using scramjet technology is expected to fly at least five

to six times faster than the speed of sound and has rumoured range between 400 and 1000 km.³ At speeds over 6000 kmph, the missile may prove to be an invincible anti-ship weapon making the interception problem all the more difficult. Although, the technical and tactical data of this hypersonic missile, 3M22 of the 3K22 Zircon system, has not been made public yet, it is expected to be produced in the ship and air launched variants for the Russian Navy. At the claimed overwhelming speeds the missile is also expected to have great manoeuvring capabilities. Meanwhile, in the hypersonic glide vehicle category, Russia's Yu-71 missile development program is progressing well. The missile is claimed to have achieved maximum speed of 11,200 kmph (Mach 10) during tests.⁴ This hypersonic missile will form part of Russia's Strategic Missile Forces.

The Russian Navy has ambitious plans for induction of Zircon weapon system. Pyotr Velikiy (Peter the Great) and Admiral Nakhimov, both 24,500 tons heavy nuclear powered Kirov class guided missile cruisers will be the first warships in the world to be armed with Zircon hypersonic missile during their refits/modernization planned between 2018 and 2022.⁵ In all probability, Zircon will replace P-800 Onyx and P-700 Granti supersonic anti-ship cruise missiles and will join the existing Kalibr NK missile system to become a potent weapon mix for these cruisers. The combat-proven Kalibr cruise missile with 4,000 km range was seen in action

last year, when it was deployed against Islamic State's (IS, formerly ISIS/ISIL) defences in Syria.⁶ The refurbishment process will see fitment of ten 3S-14 vertical launch missile systems on board each cruiser. With each system capable of carrying eight missiles (a mix of Zircon, Onyx and Kalibr) the total missile load per ship will be eighty missiles. With this heavy outfit of anti-ship missiles these ships will surely become a potent platform at sea. Keeping in mind the enormous potential, the Zircon missiles are also expected to form part of the weapon outfit for the fifth generation (5G) Husky class Russian nuclear submarines.

The U.S military research and development agencies have been slow in hypersonic weapon development. Its X-15 rocket plane and Boeing X-51 Wave rider projects have achieved limited success. During trials, X-51A Wave Rider could achieve speeds up to Mach 5.1 for three minutes with scramjet engine.⁷ The Falcon Hypersonic Technology Vehicle was also declared unsuccessful after two tests in 2010 and 2011.⁸ Presently, the Defence Advanced Projects Research Agency (DARPA) is funding projects with Lockheed Martin and Raytheon on two types of hypersonic missiles as part of the Conventional Prompt Global Strike (CPGS) program. One of them is based on boost glide system that rides a rocket into space, then re-enters the atmosphere and glides to its target at hypersonic speeds. The other is an air breathing

missile, similar to a ramjet, which hits its target at speeds up to Mach10.⁹

China, on the other hand, has progressed well in the field of hypersonic missiles. After Russia and the U.S, China is the third country to have successfully tested a hypersonic vehicle. During the last two years, China has conducted six tests of the DF-ZF (NATO name WU-14) hypersonic glide vehicle (HGV) and achieved speeds up to 12359 kmph (Mach 10) along with performing evasive manoeuvres during the glide phase.¹⁰ This Chinese missile uses a rocket booster to fly through the space-earth's atmosphere boundary, about 100 km above the ground, and thereafter glide its way to the intended target at speeds of Mach 10. It is understood that WU-14 may be initially carried by DF-21 IRBM but ultimately equipped to be boosted by ICBMs such as DF-31A or DF-41 to provide world-wide precision strike capability to the Chinese armed forces.¹¹ Although, the WU-14 is still in the development stage it surely gives China a workable test vehicle design to make it a potent weapon against the U.S carriers.

On the home front, India-Russia joint venture BrahMos Aerospace is also actively pursuing the development of "BrahMos- II", the hypersonic version of the existing BrahMos cruise missile which is already in service with Indian Navy and Army. The primary goal of the consortium is to develop a weapon capable of sustaining a top speed of Mach 7 or greater (from

the existing speeds of Mach 2.5 to 2.8) using a supersonic combustion ramjet, or scramjet engine.¹² Meanwhile, it was rumoured that the BrahMos II hypersonic cruise missile may be an export variant of the Zircon.¹³ If that is true, the BrahMos II project has jumped a step closer to achieving its goal, and obviously good news for India.

The current arms race in the hypersonic weapon world is somewhat reminiscent of the cold war situation. The U.S is pursuing its CPGS program in a deliberate manner and believes that past setbacks in the X-51 program should not prompt an end to hypersonic arms development and their goal is to develop a scramjet-powered air launched hypersonic cruise missile based on the X-51.¹⁴ China's answer to defeating advanced air defences being deployed around the world lies in the DF-ZF hypersonic glider program, which has produced very encouraging results. The success of Russia's Zircon hypersonic cruise missile tests and its advanced induction plan for the Kirov class cruisers and Husky class submarines will certainly add a big punch to its anti-ship warfare capability. On the strategic missile forces front, the development of YU-71 missile will compete with the best in the world.

The enormous speeds and quantum jump in the kinetic energy associated with these weapons can become a game changer of the future warfare. A hypersonic weapon will be able

to attack every element of the kill chain with relative impunity by compressing the enemy's decision-making window. In the maritime warfare scenario, the induction of hypersonic cruise missiles will pose a serious challenge for anti-missile defence and close in weapon systems on board warships. Russia, with the planned induction of Zircon cruise missiles on board its warships, will be a step ahead in the arms race as the first naval power to have a hypersonic weapon.

(Disclaimer: The views and opinions expressed in this article are those of the author and do not necessarily reflect the position of the Centre for Air Power Studies [CAPS])

Notes

¹ BrahMos Aerospace, accessed on 21 April 2016, <http://www.brahmos.com/content.php?id=10&sid=9>

² Russia's hypersonic Zircon missile to go into serial production in 2018, TASS - Russian News Agency, 19 April 2016, <http://tass.ru/en/defense/870751>

³ Russian Navy to have nigh-unstoppable hypersonic missiles by 2018 - report, 20 April 2016, <https://www.rt.com/news/340397-russian-army-goes-hypersonic/>

⁴ Russia's Secret Hypersonic Nuclear Missile Yu-71 Can Breach Existing Missile Defense Systems: Experts, 29 Jun 2015, <http://www.ibtimes.com/russias-secret-hypersonic-nuclear-missile-yu-71-can-breach-existing-missile-defense-1987590>

⁵n2 ibid.

⁶n2 ibid

⁷Brendan Byrne, Hypersonic Missiles Could Spark Nuclear Arms Race, World War 3, 18 April 2016, <http://www.valuewalk.com/2016/04/hypersonic-missiles-world-war-3/>

⁸Stew Magnuson , Hypersonic Weapons Race Gathers Speed , August 2015, <http://www.nationaldefensemagazine.org/archive/2015/>

August/Pages/HypersonicWeaponsRaceGathersSpeed.aspx

⁹The Problem with the Pentagon's Hypersonic Missile, 14 Apr 2016, <http://www.defenseone.com/technology/2016/04/problem-pentagon-hypersonic-missile/127493/>

¹⁰Should the Pentagon Fear China's Newest Weapon?, Missile Threat, 25 August 2015, <http://thediplomat.com/2015/08/should-the-pentagon-fear-chinas-newest-weapon/>

¹¹China, India and Russia have supersonic cruise missiles and are nearing hypersonic cruise missiles, 23 March 2015, <http://missilethreat.com/china-india-and-russia-have-supersonic-cruise-missiles-and-are-nearing-hypersonic-cruise-missiles/>

¹²James Drew quoting Praveen Pathak, GM (Mktg& Export), BrahMos pushing hypersonic ramjet technology as scramjet stopgap, 27 August 2015, <https://www.flightglobal.com/news/articles/brahmos-pushing-hypersonic-ramjet-technology-as-scramjet-416119/>

¹³M22 Zircon Hypersonic Missile in Development Testing for Russian Navy Kirov-class Cruiser, Navyrecognition.com, 19 Feb 2016,

http://www.navyrecognition.com/index.php?option=com_content&task=view&id=3587

¹⁴Bill Gertz, Hypersonic Arms Race Heats Up as U.S. Builds High-Speed Missiles, 08 March 2016, <http://freebeacon.com/national-security/hypersonic-arms-race-heats-up-as-u-s-builds-high-speed-missiles/>