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Xerxes' New Arrows? The Proliferation Risks of Hypersonic Missiles

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The Missiles of October

Of all the new military hardware that passed along the stands during the 70th anniversary of the People's Republic of China in Beijing on 1 October 2019, one of the most scrutinized weapons was the Dong Feng 17 (DF-17) short-range ballistic missile (SRBM) equipped with a hypersonic glide vehicle (HGV).[1] The first hypersonic boost-glide weapon system to enter military service worldwide, China's DF-17 illustrates that these systems are now transitioning from the weapons laboratories to operational inventories. With the development and operational deployment of the DF-17 China has broken the hypersonic glide barrier and started the ball rolling.[2] Additional arms-

1 Ankit Panda, "Hypersonic Hype: Just How Big of a Deal is China's DF-17 Missile?, *The Diplomat*, 7 October 2019, https://thediplomat.com/2019/10/hypersonic-hype-just-how-big-of-a-deal-is-chinas-df-17-missile/, accessed 30 January 2020.

2 David Axe, "Is China's DF-17 Hypersonic Missile Really a Super-weapon?", *National Interest*, 21 November 2019, https://nationalinterest.org/blog/buzz/china's-df-17-hypersonic-missile-really-super-weapon-98242, accessed 30 January 2020.

control measures will be needed, and soon, if the proliferation of such advanced systems and its impact on international security are to be managed.

Going at Warp Drive

For decades, hypersonic glide vehicles (unpowered) and hypersonic cruise missiles (powered) were an expensive pastime of weapons laboratories.[3] However, with the operational deployment of China's DF-17 and the operational testing of Russia's 3M22 Zircon, these weapons are no longer science fiction.[4] The military attraction for these kinds of weapons is easy to grasp. Their very high speed of well above Mach 5 increases the survivability of the missile and decreases the target's ability to react. But that goes for any ballistic missile. However, engaging such a weapon that is also manoeuvring at these speeds in the atmosphere, like the DF-17, is particularly demanding. Moreover, there is strategic ambiguity concerning the DF-17's warhead. Although statements by China suggest it is fitted with a conventional warhead only, such a weapon system invites a dual capability with a nuclear warhead.

Get Ready for Launch

Hypersonic missiles have an impact on international security. The existing threats posed by ballistic and cruise missiles will be compounded if these weapons proliferate on the global stage. For example, due to the combination of high speed, manoeuvrability and unpredictable flight paths, hypersonic missiles can challenge even the best missile defences now deployed and projected. This in turn might lead target nations to set up their own forces for a *launch on warning*[5]. Also, because of the difficulties of defending against hypersonic missiles, even relatively small forces can pose threats against forward-projected military forces, thereby acting as a deterrent against interventions. Furthermore, any hypersonic missile attack occurs with very little warning time. Combined with their unpredictable flight paths and the strategic ambiguity surrounding their warheads, they compress the timeline for response. Or, to put it bluntly, hypersonic missiles increase crisis instability.[6]

Blotting Out the Sun?

At the start of the Battle of Thermopylae in 480 BC, the Persian leader Xerxes ordered 5,000 archers to fire a barrage of arrows at the Greeks, threatening to "blot out the sun". Missiles are the arrows of the present day and Iran has long been investing in missile technology. Its missile arsenal appears to be a top priority for Iran's Revolutionary Guard Corps. Even though Iran does not appear to be developing hypersonic missiles, its strengthening military ties with China certainly provide the scope to do so.[7] Both countries signed an agreement on military cooperation in 2016.[8] Moreover, the technical facilities and research & design efforts for work on hypersonic missiles are already in place. For instance,

3 See the GOA factsheet for explanation and overview of the issues: https://www.gao.gov/assets/710/701369.pdf.

4 The hypersonic flight regime is considered to begin at Mach 5 (approximately 5,000 kilometers per hour), with the first generation of glide vehicle weapons at Mach 10, while the cruise missiles are in the Mach 5-7 range.

5 *Launch on warning* is defined as a strategy in which a retaliatory attack is launched before an opponents' incoming missiles have reached their designated targets.

6 Douglas Barrie, "Unstable at Speed: Hypersonics and Arms Control", *International Institute of Strategic Studies Military Balance Blogpost*, 18 October 2019, https://www.iiss.org/blogs/military-balance/2019/10/hypersonics-arms-control, accessed 30 January 2020.

7 Farzin Nadimi, "Iran and China are Strengthening their Military Ties", *The Washington Institute*, 22 November 2016, https://www.washingtoninstitute.org/policy-analysis/view/iran-and-china-are-strengthening-their-military-ties, accessed 30 January 2020.

8 Franz-Stefan Gady, "Iran, China Sign Military Cooperation Agreement", *The Diplomat*, 15 November 2016, https://thediplomat.com/2016/11/iran-china-sign-military-cooperation-agreement/, accessed 30 January 2020.

in March 2014 Iran completed construction of its first hypersonic wind tunnel, which is located at the University of Teheran and is capable of testing speeds of up to Mach 8.[9] Furthermore, scholars from the Babol University of Technology have identified how vehicles traveling at hypersonic speeds could benefit from counterflowing jets as a cooling system upon re-entry in the atmosphere.[10] Coupled with Iran's stated intention to continue to develop ballistic missiles, there is a clear risk of proliferation.

Dual Design for Denial

There are two approaches to containing the proliferation of hypersonic missiles and their technology within the context of arms control. First, a multilateral policy of export denial by China, Russia, the United States and other countries for complete delivery vehicles and their major subsystems. Second, a policy of case-by-case export reviews for technological items such as scramjets and other hypersonic engines, fuels for hypersonic use, sensors, navigation and communication equipment for hypersonic flight, hypersonic flight controls and design tools and modelling for such uses, and simulation and testing of hypersonic vehicles.[11] These are all specific hypersonic technologies that could be made subject to export controls under the existing model of the 35-nation Missile Technology Control Regime (MTCR).[12] At the moment, however, the MTCR only aims to inhibit the proliferation of missiles *capable of delivering nuclear, chemical, or biological (NBC) payloads*.[13] But, as was noted previously, hypersonic missiles need not deliver a mass destruction warhead in order to be operationally and strategically effective. Furthermore, while Russia is a member of the MTCR, China is not.[14]

Putting a Lid on Hypersonic Kit

We have put a spotlight on the key technologies that are at risk for proliferation of hypersonic missiles to countries of concern, like Iran. A key feature of the MTCR that is currently affecting its application to hypersonic weapons is that it is designed to control only the proliferation of ballistic and cruise missiles capable of delivering NBC payloads. Even though it was broadened to place similar restraints against missiles *intended* to deliver these payloads, hypersonic missiles do not easily fit into these categories. Redesigning the MTCR in order to direct its restraints against such destabilising weapons implies a major change in its focus. Therefore, we recommend that the key technologies associated with hypersonic missiles at least be subject to export restraints under the existing MTCR guidelines. Moreover, these technologies should also be a concern for policymakers when examining export applications to countries like Iran.

9 Umid Niayesh, "Iran Builds First Hypersonic Wind Tunnel to Test Missiles and Spacecraft", *Trend News Agency*, 5 March 2014, https://en.trend.az/azerbaijan/politics/2249244.html, accessed 30 January 2020.

10 Misagh Imani et al. "Heat Reduction Using Counterflowing Jet for a Nose Cone with Aerodisk in Hypersonic Flow", https://www.academia.edu/31798070/Accepted_Manuscript_Heat_reduction_using_conterflowing_jet_for_a_nose_cone_with_Aerodisk_in_hypersonic_flow, accessed 30 January 2020.

11 Richard Speier, George Nacouzi, Carrie Lee, Richard Moore, *Hypersonic Missile Nonproliferation: Hindering the Spread of a New Class of Weapons* (Santa Monica, CA: RAND Corporation, 2017) https://www.rand.org/pubs/research_reports/RR2137.html, accessed 30 January 2020.

12 Missile Technology Control Regime (MTCR), Equipment, Software and Technology Annex, 11 October 2019, https://mtcr.info/wordpress/wp-content/uploads/2019/10/MTCR-TEM-Technical_Annex_2019-10-11-1.pdf, accessed 30 January 2020.

13 Missile Technology Control Regime (MTCR), Annex Handbook 2017, https://mtcr.info/wordpress/wp-content/uploads/2017/10/MTCR-Handbook-2017-INDEXED-FINAL-Digital.pdf, accessed on 30 January 2020.

14 China does claim to observe (a version of) the MTCR.

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