



Development and Budgeting of U.S. Hypersonic Defence Projects

Marcin Andrzej Piotrowski

In parallel to the development of hypersonic weapons, the Americans are also researching active defences against this kind of threat. So far, the Pentagon has revealed few of its hypersonic defence (HD) projects, although the U.S. Congress each year has increased funds for these efforts. The first generation of HD systems will force a choice between the most effective systems and the use of elements of “classic” missile defence. The resulting increased deterrence potential of the U.S. in Asia and Europe might be favourable for its allies, which have no real capabilities to build indigenous, holistic, and integrated HD systems.

Complexity of Hypersonic Threats. In recent years, China and Russia initiated the introduction of hypersonic weapons, which are manoeuvring missiles with speeds above Mach 5 (1.5 km/s). [In the U.S., the prevailing opinion is that the American offensive projects are far behind the tempo of development of hypersonic armaments by China and Russia.](#) The concerns of the U.S. and its allies in Asia stem from the Chinese DF-17 and XK-2 missiles, and in NATO by the Russian Kinzhal and Tsirkon missiles. These missiles are a potential threat to surface vessels groups, air and missile defence systems, and U.S. air and naval bases in Asia and Europe. Hypersonic weapon strikes are seen as an advantage and increase the effectiveness of subsequent enemy salvos of ballistic and cruise missiles.

A hypersonic weapon attack is an extremely complex challenge for early warning and defence systems due to the missile’s speed, manoeuvrability, and unpredictable trajectory, as well as the uncertainty of its target and delivered warhead (conventional or nuclear). Another advantage of hypersonic weapons is the perceived ineffectiveness of “classical” missile warning and defence systems. Typical early warning radars are incapable of fully tracking hypersonic targets to give a chance for immediate reaction. Early warning satellites at higher orbits also have limitations, as they are unable to track targets that are only gliding in the atmosphere. However, hypersonic threats might be countered with new technologies. This kind of defence needs much broader capabilities to track all potential trajectories of a threat from space (in low earth orbit) and to

intercept them in the glide phase. For all these reasons, the [U.S. 2019 “Missile Defense Review” recognised the priority of hypersonic defence.](#) There already have been studies on different kinetic and non-kinetic options for HD. A separate issue might also be passive HD, which would also lower enemy hypersonic threats by concealment, dispersal, and mobility of defender forces.

Likely U.S. HD Systems. Since 2015, the Pentagon has been conducting a variety of studies on HD, which may strengthen integrated missile defence and the credibility of the U.S. conventional deterrence. Despite changes in the U.S. Congress during the last five years, each year it has funded HD projects at levels much higher than requested by the Missile Defense Agency (MDA) or Defense Advanced Research Projects Agency (DARPA). The MDA budget for 2020 was increased from the requested \$132 million to \$390 million. The MDA’s budget request for 2021 assumed \$206 million but Congress approved \$272 million. The MDA’s request for 2022 would be a slight decrease in the HD budget to \$247.9 million, however it is expected Congress will again increase it. A similar trend is observed regarding budgeting for some partially classified DARPA projects as well as some aspects of HD within the budget of the new Space Development Agency (SDA).

American HD might be based partially on existing systems, on some important modification of them, or on totally new projects. Industry is assuring that the capabilities for tracking

hypersonic weapons are within the ranges of their radars, such as the AN/SPY-6 and LTAMDS. However, these radars' are limited to the terminal phase of hypersonic flight. The U.S. investments are focused on developing capabilities that will indicate a threat in the start phase and then track them across their mid phase, the longest and most manoeuvrable. Demonstrations of this kind of tracking of the glide phase is envisioned in the plans for DARPA's Blackjack micro-satellites. Also, after 2022 or 2023 more capabilities might be ensured by satellites with wider spectrums of observation (WFOV), and lower orbit constellations of satellites of type of HBTSS and SSL. Since 2020, the Pentagon has also focused research on missile interceptors, foreseen to ensure defence capabilities at the regional (tactical) level. The first competition by the MDA included three concepts based on existing interceptors—Dart (THAAD), Hawk (SM-3), and Valkyrie (PAC-3). In April 2021, the Pentagon also announced that some of these projects might be integrated within the new Glide Phase Intercept (GPI) capability based on the Aegis system and two layers of defence and two kinds of interceptors. GPI would use interceptors with longer ranges to counter threats in their glide phase and ones with shorter range to counter them during the terminal phase of flight. Available information does not allow for a conclusion whether the integrated GPI system will include already tested SM-6IB interceptors or there will be follow-up to the DARPA Glide Breaker interceptor. The MDA also accepted a project to develop the Hyvint interceptor and non-kinetic weapons, perhaps measures disrupting missiles by microwaves or decoys to mislead the enemy.

Implications for U.S. Allies. Development of American active HD is a response to the growing hypersonic weapon arsenals of China and Russia, especially in the regional range (operational-tactical). The U.S. projects are pioneering in nature and with a constantly growing budget, they have the chance to be operational in the 2025-2030 period. Because HD projects will increase the capabilities of the U.S. forces in Asia and Europe, it might be assumed that no changes in budget will accompany the Biden administration's reviews of the U.S. defence strategy and missile defence. Although many aspects of HD projects are classified, it is clear that the Pentagon is focused on early warning and tracking satellites. The second direction of efforts

is focused on the development of double-layered regional defences, which likely be based on vessels with Aegis systems. The majority of MDA projects suggest an evolutionary approach—adaptation of existing systems and interceptors to specific needs of HD—however, it cannot be excluded that the Pentagon is also developing more revolutionary and non-kinetic HD technologies. It should be noted that [offensive hypersonic weapons are not foreseen to be included in the U.S. dialogue on arms control with Russia and China anytime soon](#). But both competitors of the U.S. will likely start the development of technical counter-measures against HD systems.

American regional HD systems will be deployed first and on a bigger scale in Asia in response to China's hypersonic weapons. But soon after, HD systems also could be deployed in Europe because there, the U.S. [allies recognise Russia's whole arsenal \(besides cruise and ballistic missiles, also hypersonic weapons\) as a crucial threat to NATO](#). Defence of NATO based on American HD systems could be an essential augmentation of the Alliance's conventional deterrence and defence against all classes of Russian missiles. A condition for HD defences will be the integration of NATO systems with the planned American satellites, such as WFOV and HBTSS. Deployment of even a limited number of Aegis-GPI system vessels would complicate Russian military planners' work by introducing uncertainty about the effectiveness of their hypersonic weapons at the beginning of a hypothetical conflict with NATO.

The American technological advances in all aspects of HD may in the next few years undermine European terminal-phase HD projects, such as the MBDA Twister demonstrator planned for after 2030, but which basically duplicates the U.S. HD efforts. The future shape of allied HD architecture should be included among the priorities of the new Defence Innovation Accelerator for the North Atlantic (NATO DIANA). Awareness in NATO states that U.S. forces have at their disposal adequate measures of tracking and intercepting hypersonic weapons would also encourage Europeans to make increased investments in "classical" air and missile defence capabilities. Such an approach likely would decrease the controversy about financial burden-sharing within NATO, although the concerns of some countries that in yet another area of defence Europe will become technologically dependent on the U.S.