Classified Report On Hypersonics Says U.S. Lacking Urgency

U.S. is losing momentum in hypersonic arms race as China, Russia catch up, says report

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Less than four years ago, it seemed that the U.S. Air Force was on the brink of developing the first generation of air-breathing high-speed strike weapons following the success of the experimental scramjet-powered Boeing X-51A. Now a classified report warns that the U.S. may be losing its lead in hypersonics to China and Russia.

Although parallel research on hypersonic glide vehicles under DARPA's HTV-2 program suffered failures in 2010 and 2011, the Air Force by 2013 appeared enthusiastic about weaponizing the maturing air-breathing technology demonstrated in the X-51A flight tests. After more than five decades of development and testing in high-speed flight, the U.S. finally looked set to become the undisputed leader in hypersonics.

But as China and Russia demonstrate dramatic strides in the technology, the U.S. is in danger of falling behind, warns a classified report by the National Academies of Sciences, Engineering and Medicine now being briefed to senior Pentagon officials. Unless greater urgency and cohesiveness are injected into this crucial area of defense technology, the report says, the U.S. will become vulnerable to the threat from a new class of superior high-speed maneuvering weapons.

The report, commissioned by the Air Force in early 2015, was published late last year and has already been reviewed by the Air Force Research Laboratory and defense acquisition officials. "The good news is that everyone who has seen it so far says it makes sense," says Mark Lewis, chairman of the National Academies' Committee on Future Air Force Needs for Defense Against High-Speed Weapon Systems, which produced the report.

Are China and Russia threatening the U.S. lead in hypersonic propulsion? Credit: AW&ST Art Department Concept

“We are briefing it around town,” adds Lewis, who explains that although the committee’s charter was to focus on defense, the report also discusses developing offensive capabilities for both a counter and a defensive response. “You really cannot talk about defensive capabilities without linking them to offensive components. We were not making recommendations on what the Air Force should do in terms of developing its own hypersonic systems per se, but embedded in the report is the notion that you need to have your own developmental efforts,” he says.

The U.S. is currently pursuing two main hypersonic development paths led by DARPA, with the Air Force, aimed at flight tests by 2019. Under the first initiative, Lockheed Martin and Raytheon are working competitively on an air-launched, rocket-boosted and scramjet-powered successor to the X-51A dubbed the Hypersonic Air-breathing Weapon Concept (HAWC). The second path is the Tactical Boost Glide (TBG) program under which Lockheed Martin is developing an unpowered hypersonic vehicle that will detach from the air-launched rocket stage in the upper stratosphere and glide to its target.

The DARPA/Air Force HAWC program will not fly a scramjet-powered missile demonstrator until 2019, six years after the last X-51A flight. Credit: Lockheed Martin

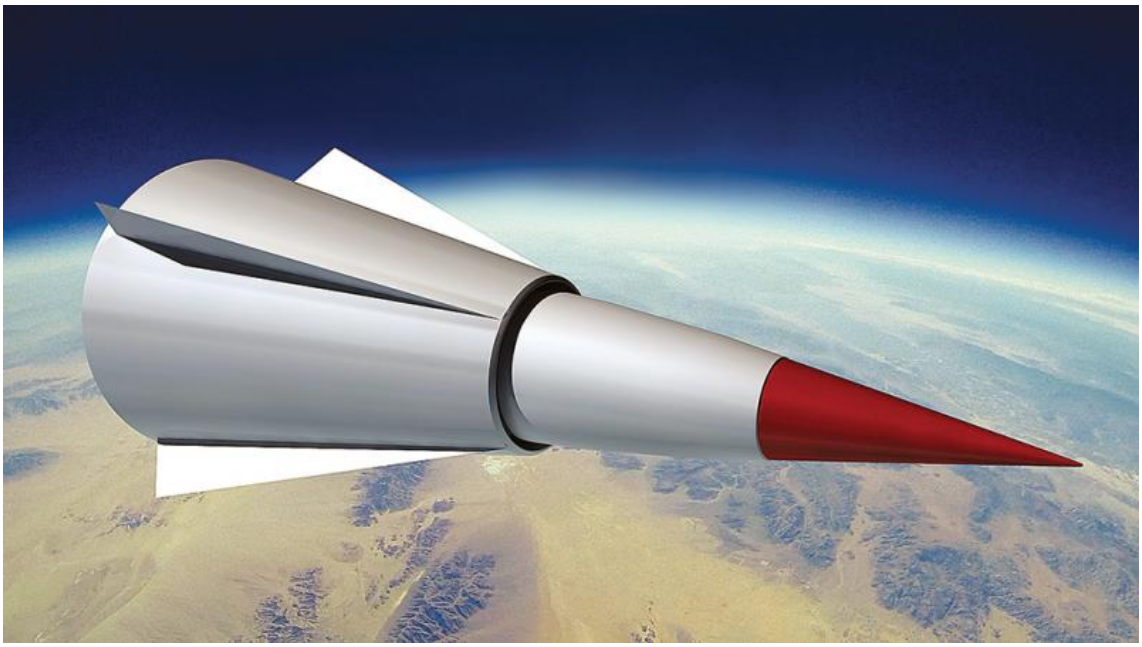
Unlike a conventional ballistic-missile reentry vehicle, the hypersonic glide vehicle will be capable of aggressive maneuvers on its run to the target, making interception by even such advanced surface-to-air missile systems as the recently tested Raytheon Standard Missile-3 Block IIA guided missile more difficult. In addition, because the weapon is injected at high speed into the stratosphere, anti-missile defense systems will have much less time to respond.

China and Russia are accelerating development of air-breathing and boost-glide hypersonic weapon systems, and both are believed to be targeting 2020 for deployment of the first operational units. The alarm at the Pentagon was first sounded in early 2014 when U.S. space-based sensors detected Chinese tests of a hypersonic glider boosted by a DF-21 medium-range ballistic missile. Dubbed the DF-ZF by China and the WU-14 by the U.S, the vehicle has since been tested several times on a variety of both solid- and liquid-fueled ballistic missiles.

In October 2015, it also emerged that China had successfully tested a scramjet-powered hypersonic vehicle when the project's leader, Wang Zhenguo, a professor at the National University of Defense Technology, was recognized for the achievement.

Russia is developing a series of hypersonic glide vehicles under its Project 4202 weapons program. Initial flights of the experimental Yu-71 atop an SS-19 missile took place in 2015 from Dombarovsky missile base in Orenburg, close to the border with Kazakhstan in southern

Russia. Tests of a more advanced vehicle, the Yu-74, were observed in 2016. The newer vehicle was launched from Orenburg on an RS-18A ballistic missile and targeted at Russia's Kura test range in Kamchatka. The program's stated aim is development of conventional or nuclear-armed hypersonic glide warheads for the Makayev-designed RS-28 Sarmat next-generation ICBM, which is due to enter service around the end of the decade.



Notional artist's impression of China's DF-ZF hypersonic glide vehicle, which is boosted to its high cruise speed by a ballistic missile. Credit: Daniel Toschlager and Jay Mantri/Wikimedia

Although Russia has also researched and developed air-breathing hypersonic vehicles for many decades, including the Kh-90 (AS-19 Koala) high-speed cruise missile, it also appears to have been making steady progress in tests of a variety of hydrogen-fueled scramjet-powered experimental waverider-type vehicles developed by the Gromov Flight Research Institute. The latest of these, the GLL-AP-02, is provisionally targeted for test flights in 2018-19.

In light of these advances, the National Academy report warns that U.S. efforts, in contrast, appear to be losing momentum and focus. "We also wanted to communicate a sense of urgency," says Lewis. "Even the programs that we have underway do not seem to be demonstrating that sense. If HAWC flies when it is supposed to fly, that is 2019. That's almost a decade after the first flight of X-51. You hear things such as, 'We will develop in 2030, 2040.' For crying out loud, what's taking so long?"

But why the urgency? Other nations, says an unclassified, redacted version of the report, "have taken advantage of data and lessons learned from the U.S. and have been helped by the start-stop approach to technology development (including canceling programs even after major successes) and inefficiencies in the U.S. acquisition processes." As a result, the committee concluded, the U.S. "may be facing a threat from a new class of weapons that will

effectively combine speed, maneuverability and altitude in ways that could challenge this nation's tenets of global vigilance, reach, and power."

"We pointed out that if you have maneuvering, high-speed systems available, you can now take on the world's greatest military with a lesser navy and a lesser air force," says Lewis. "You don't need to go ship-to-ship if you can hold the Navy at risk with a new weapon and can produce these effects without investing in a comparable military force. That was part of our warning to the Air Force as well." Referring to the greater long-range threat posed by these weapons, Lewis adds, "If we are forced to stay farther and farther away, it absolutely changes the way we do things."

Two flights of DARPA's HTV-2 high lift/drag hypersonic glider ended after 9 min. when the vehicles were lost after pull-up from reentry. Credit: DARPA

Hypersonic development also needs to be focused and organized as a national priority, says the report. "The committee overall realized the programs just are not coherent. There are projects and concepts, but the field would benefit from more national-level direction," says Lewis. With technologies already well advanced, the report recommends that more leadership should be shown by the services, rather than leaving this role to research organizations such as DARPA. "The Air Force hasn't really taken ownership. One of the things we have been asking about is plans for an analysis of alternatives [AoA], so why isn't an AoA being done now?," says Lewis. We call this out in the report, but it is out of our scope to make that level of recommendation. We also believe the Air Force should be doing its own experimentation."

Others involved in U.S. hypersonics support the report's recommendations. Kevin Bowcutt, senior technical fellow and chief scientist for hypersonics at Boeing Research and Technology, says "many lessons on the path to X-51A success were hard-earned. Given the criticality of hypersonics as articulated in the report and with X-51A under our belt, there would be obvious value in leveraging this extensive experience and know-how to accelerate full-scale development of an operational hypersonic vehicle or weapon."

Bowcutt also believes the U.S. needs to create "a comprehensive national plan with adequate funding that fields offensive and defensive hypersonic capabilities as quickly as technology maturation, system integration and capability demonstration allow."

"It is a big problem for us. We have been kind of resting on our laurels," says Leon McKinney, president of McKinney Associates and former executive director of the U.S. hypersonics industry team. "The U.S. has been fighting wars and terrorism, so that is one of the reasons why we have not seen a burst of capability developments. But it seems our adversaries are catching up."

McKinney backs a three-phased approach to spurring development of a boost-glide capability, starting with a focus on an offensive hypersonic system that he believes could still be fielded within three years. Development of a defensive system, which McKinney says is "tough," would aim at characterizing Chinese and Russian vehicle maneuvering capabilities to produce a "threat tube," to enable effective interdiction. A third element would include development of a maneuvering target vehicle "which we could engage as a simulated threat."

The report does not specify that current programs should be abandoned, "but we think there are some programmatic changes we need to see," says Lewis. "We just say, step on the gas and move these programs forward. If you want to map out a strategy to get you from the things we have tested to an operational system, one would argue we are not on that track."