Intermediate Range Conventional Prompt Strike missile

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U.S. hastens advancements on ultra-fast hypersonic weapons

Hypersonic Conventional Strike Weapon

By Matt Alderton

The world's first long-range ballistic missile, Nazi Germany's V-2 rocket, was a technological triumph with tragic consequences. Developed by German rocket scientist Wernher von Braun, it breached Earth's atmosphere for the first time on Oct. 3, 1942. It made its operational debut two years later, after which the Nazis fired at least 3,200 at Allied targets in Western Europe. The missiles are estimated to have killed approximately 5,500 people and to have seriously wounded another 6,500, to say nothing of the 10,000 concentration-camp prisoners who died assembling them.

What made the V-2 so remarkable — and so lethal — was its speed. Outfitted with a 1-ton warhead, it could travel up to 200 miles at a velocity of up to 3,300 mph. After launching from a mobile ground platform, the liquid-fueled rocket ascended approximately 60 vertical miles on an arced course, reaching space before falling on its target at such force it bored several feet into the ground before detonating. Its combined tempo and trajectory made it virtually impossible to intercept.

As groundbreaking as it was in 1942, the V-2 seems almost quaint nearly 80 years later. That's because the world's preeminent weapons have evolved from ones that can travel at supersonic speeds, like the V-2, to ones that can travel at hypersonic speeds. On the battlefield, it will no longer be enough to have the world's largest military — victory will belong to the world's quickest.

'AN IDEAL OFFENSIVE WEAPON'

Much like in the popular fable *The Tortoise and the Hare*, many Americans often believe that tenacity triumphs over speed. In modern warfare, however, tortoises are toast. Instead of "slow and steady," "fast and forceful" wins the race.

Enter hypersonic weapons, which are designed to travel at Mach 5 or greater — at least five times the speed of sound. "That's about 3,800 mph, or about 1 mile per second," said Margot van

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NEED for SPEED

Loon, a fellow in defense studies at the American Foreign Policy Council. "That is significantly faster than even our fastest fighter jets, which can travel for short distances at Mach 2 and 3, but can't get up to Mach 5 ... It's a huge jump forward in terms of capabilities."

Hypersonic weapons aren't just fast, they're also highly maneuverable. "Their travel isn't restricted to the traditional parabolic trajectory of a ballistic missile. They can be steered and controlled, which makes their flight paths very unpredictable," van Loon continued. "That's a huge advantage for whoever is deploying them."

Furthermore, hypersonic weapons are difficult to intercept. "Because they go so fast, these missiles have the capacity to evade most missile defense systems now in existence," explained Michael Klare, a senior visiting fellow at the Arms Control Association. "It's very hard to develop a defense system that can detect a moving missile, determine where it's headed and fire a projectile that knocks it out of the sky. Hypersonic missiles will make that even more difficult, and that makes them an ideal offensive weapon."

RACING TOWARD THE FUTURE

They may seem cutting-edge, but hypersonics date back more than 60 years.

"The United States was the first country to start the development of these technologies as far back as the late 1950s or early 1960s," van Loon said. "But once the Cold War ended, we fell back on our laurels a bit."

That begs the question: If the U.S. pressed "pause" on hypersonic development, why is it pressing "play" again now?

There are technological reasons, certainly. "The biggest issue we're dealing with in hypersonics is heat dissipation. Advancements in material science have allowed us to dissipate heat on smaller, more tactical weapons in a cost-effective manner," said Wesley Kremer, president of Raytheon Missile Systems, one of several defense contractors developing hypersonics in partnership with the Department of Defense (DOD). "The other aspect is computer-aided design. We now have the computing power to (solve the engineering challenges inherent in) things that travel at such high speeds. Those two things coming together has really brought us to where we are now."

Air-Launched Rapid Response Weapon

The most conspicuous trigger, however, is foreign policy: China's DF-17 hypersonic missile became operational in October, while Russia's version, the Avangard, is expected to be operational in 2020.

"The U.S. has been a world leader in hypersonic technology for decades; however, we have consistently made the decision not to weaponize that technology," said Lt. Col. Robert Carver, a DOD spokesman. "On the other hand, over the past decade, China and Russia have aggressively pursued weaponization of hypersonic technology and have moved towards near-term fielding of operational systems ... Because China and Russia have (done so), we have no option but to accelerate our development of hypersonic strike systems."

Carver's logic is consistent with the 2018 National Defense Strategy, which instructs the U.S. military to reorganize around great-power competition — potential conflicts with China and Russia, both of which boast sophisticated missile defense systems — instead of counterinsurgency.

"We just spent 18-plus years in the global war on terror, and our services have done a great job with that fight," said Lt. Gen. L. Neil Thurgood, director of hypersonics, directed energy, space and rapid acquisition for the U.S. Army. "But the tools we needed for that fight are different than the tools we need for great-power competition."

A TEAM EFFORT

Unwilling to let China and Russia dominate, the U.S. began speeding toward its own hypersonic weapons in June 2018, when senior military leaders signed an agreement to jointly develop a hypersonic glide vehicle — a weapon that uses a rocket to boost it to its maximum speed and altitude, at which point the warhead separates and glides toward its target. The American version, the Common Hypersonic Glide Body (C-HGB), will be shared across the services.

"Fielding hypersonic weapons is DOD's highest technical research and engineering priority," Carver said.

The Navy is leading design of the C-HGB and also developing a submarine-launched booster system capable of deploying hypersonic weapons at sea. The Air Force, meanwhile, is developing its own booster system that will air-launch hypersonic weapons from a B-52.

The Army's contribution is two-fold. First, it will lead production of the C-HGB. Second, it will develop the

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Army Long Range Hypersonic Weapon (LRHW), its own class of hypersonic missiles launched from mobile ground platforms. A prototype is expected by 2023, and in March 2019 the Army selected two prime contractors to help build it: Dynetics Technical Solutions (DTS) and Lockheed Martin. The latter, which also is working with the Air Force on its effort, will develop the LRHW's ground-based launcher and integrate it with the C-HGB. With help from numerous partners — including Raytheon, which will supply the control system — the former will manufacture an initial set of C-HGB prototypes, and will produce the LRHW launcher as a subcontractor for Lockheed.

The technology has been proved. What's needed now is the means to produce it at scale. "All of the work to date has been done by the science and technology community ... The challenge now is to move that intellectual capital out of government labs and into the commercial marketplace," explained Thurgood, who said the federal scientists who developed the C-HGB will spend the next year teaching it to DTS on-site at Sandia National Laboratories.

"We're taking a design that was developed and flight-tested successfully by Sandia National Labs ... and we're working with them to turn their knowledge into a manufacturable weapons system that can be deployed and work every time the way it should," said Steve Cook, DTS president.

Rival defense contracting companies like DTS, Raytheon and Lockheed must similarly unite. "Whereas we once would compete head-to-head, a mission of this importance calls for us to collaborate," said Eric Scherff, vice president for hypersonic strike programs at Lockheed Martin Space Systems. "It's all about capacity and making sure we have the wherewithal to get into a position of superiority again."

While hypersonic offense can help the U.S. regain military superiority, hypersonic defense will be needed to maintain it. That responsibility falls to the Missile Defense Agency, which in October selected Northrop Grumman, Raytheon, Leidos and L3Harris to design space-based sensors capable of tracking incoming hypersonic missiles, with the ultimate goal of intercepting them.

"The counter-hypersonic mission is actually a much more challenging problem to solve," said Kremer. "If you're on offense, you only have to get lucky once. But if you're on defense, you have to score 100 percent every time."

DOMINANCE OR DISASTER?

The elephant in the room is nuclear warfare. Although the U.S. thus far has said it will use hypersonic weapons only with conventional warheads, China and Russia have made no such assurances.

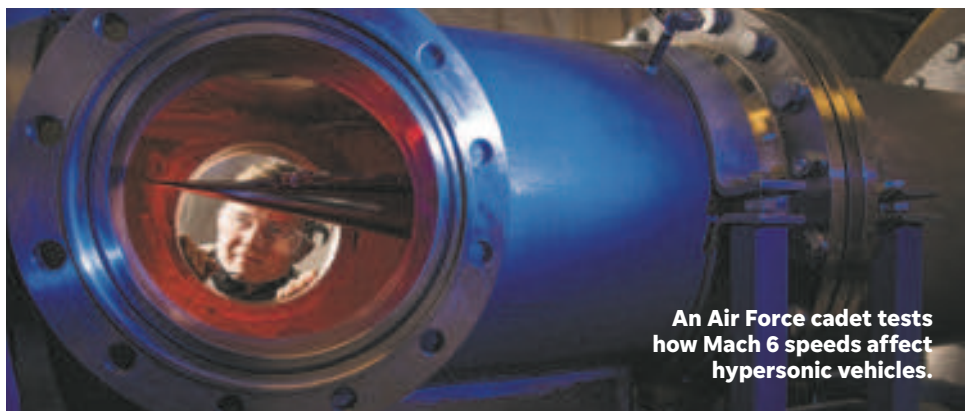
"We fear that the introduction of hypersonic weapons in large numbers on the battlefield will reduce nuclear stability and make it more likely that a crisis will escalate rapidly," said Klare, who offered a hypothetical scenario in which the U.S. launches a torrent of hypersonic weapons on Russia. Because of hypersonic weapons' speed, the Russians would have 10 minutes or less to determine whether it was a nuclear or conventional attack.

"That's not a lot of time. What if they make the wrong decision and launch their own weapons? That's the fear, because hypersonic weapons reduce decision-making time and increase ambiguity."

While new or strengthened arms control treaties could mitigate such risks, the U.S. and Russia — both of which recently withdrew from the 1987 Intermediate-Range Nuclear Forces treaty — have demonstrated a preference for leaving instead of joining such agreements.

And so the hypersonic arms race sprints forward.

"As we move into great-power competition and seek to maintain battlefield dominance, we must ensure our technological leadership in the advanced warfighting capability enabled by hypersonic systems," Carver concluded.



An Air Force cadet tests how Mach 6 speeds affect hypersonic vehicles.

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