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Russia vs. China vs. America: The Hypersonic Weapons Arms Race Is Here

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Air Force senior officials have said the service wants to build upon the successful hypersonic flight test of the X-51 Waverider 60,000 feet above the Pacific Ocean in May of 2013.

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A recent Air Force Studies Board report identified that the U.S. is not alone in its quest for this increased speed, an Air Force statement said.

The statement went on to say that China and Russia are already flight testing hypersonic weapons, and several other countries have shown interest in pursuing many of the underlying technologies for hypersonic flight.

“We must push the boundaries of technology in every area," Air Force Chief of Staff Gen. David L. Goldfein said in a statement. "Our adversaries aren’t standing still. They are looking for every advantage they can get.”

While expressing growing concern about Russian and Chinese hypersonic weapons progress, US developers have been progressing with hypersonic flight and hypersonic weapons possibilities for several years.

Describing the trajectory of hypersonic technology in terms of “stair steps,” Air Force Chief Scientist Geoffrey Zacharias said incremental progress will require decades of continued technological development.

While unmanned hypersonic surveillance flight is on track for the 2030s, launching recoverable hypersonic drones is not expected be possible until the 2040s, Zacharias said in an interview with Scout Warrior.

Air Force weapons developers expect to operate hypersonic intelligence, reconnaissance and surveillance drones by the 2040s, once scientific progress with autonomy and propulsion technology matures to a new level.

The advent of using a recoverable drone platform able to travel at high altitudes, faster than Mach 5, will follow the emergence of hypersonic weapons likely to be operational in the mid-2020s.

By the 2040s, however, the Air Force could very well have a hypersonic "strike" ISR platform able to both conduct surveillance and delivery weapons, he added.

Hypersonic Weapons Technology:

Since hypersonic vehicles can travel in a parabola-type flight path, they rise very high up into the atmosphere to reach hypersonic speeds before returning to lower altitudes.

Developing recoverable drones is much more challenging given the level of autonomy and re-entry needed for hypersonic vehicles to descend and perform ISR missions.

"A booster sends it into the atmosphere and then it dives down to its target," Zacharias said. "A re-entry vehicle would need to be maneuverable with sufficient wing area so it can avoid counter-missiles. We need to design that chamber and make it stable to allow for maneuver."

The advantages of hypersonic ISR drone flight are multi-faceted.

"You could fuel one of these to go for 1,000 miles in ten minutes. It speeds up the kill chain," he said.

Hypersonic drones could quickly reach long-range targets to perform a variety of missions such as testing enemy air defenses, surveillance missions and even precision strike operations. These drones could identify far away targets much faster while ensuring that manned aircraft remain at a safe distance.

While today's cruise missiles travel at speeds up to 600 miles per hour, hypersonic weapons will be able to reach speeds of Mach 5 to Mach 10, Air Force officials said.

A weapon traveling at hypersonic speeds, naturally, would better enable offensive missile strikes to destroy targets such as enemy ships, buildings, air defenses and even drones and fixed-wing or rotary aircraft depending upon the guidance technology available.

Last year, the Air Force launched several hypersonic speed "test flights" as part of a joint program with Australia.

Some of the remaining scientific challenges to sustaining hypersonic drone flight include developing an ability for vehicles to operate at very high temperatures, Zacharias said.

The Air Force will likely have high-speed, long-range and deadly hypersonic weapons by the 2020s, providing kinetic energy destructive power able to travel thousands of miles toward enemy targets at five-times the speed of sound.

“Air speed makes them much more survivable and hard to shoot down. If you can put enough fuel in them that gets them a good long range. You are going roughly a mile a second so if you put in 1,000 seconds of fuel you can go 1,000 miles - so that gives you lots of standoff capability,” Zacharias said.

While much progress has been made by Air Force and Pentagon scientists thus far, much work needs to be done before hypersonic air vehicles and weapons are technologically ready to be operational in combat circumstances.

“Right now we are focusing on technology maturation so all the bits and pieces, guidance, navigation control, material science, munitions, heat transfer and all that stuff,” Zacharias added.

A super high-speed drone or ISR platform would better enable air vehicles to rapidly enter and exit enemy territory and send back relevant imagery without being detected by enemy radar or shot down.

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A key component of this is the fact that weapons traveling at hypersonic speeds would present serious complications for targets hoping to defend against them – they would have only seconds with which to respond or defend against an approaching or incoming attack.

Hypersonic weapons will quite likely be engineered as “kinetic energy” strike weapons, meaning they will not use explosives but rather rely upon sheer speed and the force of impact to destroy targets.

“They have great kinetic energy to get through hardened targets. You could trade off smaller munitions loads for higher kinetic energy. It is really basically the speed and the range. Mach 5 is five times the speed of sound,” he explained.

The speed of sound can vary, depending upon the altitude; at the ground level it is roughly 1,100 feet per second. Accordingly, if a weapon is engineered with 2,000 seconds worth of fuel – it can travel up to 2,000 miles to a target.

“If you can get control at a low level and hold onto Mach 5, you can do pretty long ranges,” Zacharias said.

Although potential defensive uses for hypersonic weapons, interceptors or vehicles are by no means beyond the realm of consideration, the principle effort at the moment is to engineer offensive weapons able to quickly destroy enemy targets at great distances.

Some hypersonic vehicles could be developed with what Zacharias called "boost glide" technology, meaning they fire up into the sky above the earth's atmosphere and then utilize the speed of decent to strike targets as a re-entry vehicle.

For instance, Zacharias cited the 1950s-era experimental boost-glide vehicle called the X-15 which aimed to fire 67-miles up into the sky before returning to earth.

China's Hypersonic Weapons Tests:

Zacharias did respond to recent news about China's claimed test of a hypersonic weapon, a development which caused concern among Pentagon leaders and threat analysts.

While some Pentagon officials have said the Chinese have made progress with effort to develop hypersonic weapons, Zacharias emphasized that much of the details regarding this effort were classified and therefore not publically available.

Nevertheless, should China possess long-range, high-speed hypersonic weapons – it could dramatically impact circumstances known in Pentagon circles and anti-access/area denial.

This phenomenon, referred to at A2/AD, involves instances wherein potential adversaries use long-range sensors and precision weaponry to deny the U.S. any ability to operate in the vicinity of some strategically significant areas such as closer to an enemy coastline. Hypersonic weapons could hold slower-moving Navy aircraft carriers at much greater risk, for example.

An April 27th report last year in the Washington Free Beach cited Pentagon officials stating that China successfully tested a new high-speed maneuvering warhead.

"The test of the developmental DF-ZF hypersonic glide vehicle was monitored after launch Friday atop a ballistic missile fired from the Wuzhai missile launch center in central China, said officials familiar with reports of the test," the report from the Washington Free Beacon said. "The maneuvering glider, traveling at several thousand miles per hour, was tracked by satellites as it flew west along the edge of the atmosphere to an impact area in the western part of the country."

X-51 Waverider:

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The successful test was particularly welcome news for Air Force developers because the X-51 Waverider had previously had some failed tests.

The 2013 test flight, which wound up being the longest air-breathing hypersonic flight ever, wrapped up a $300 million technology demonstration program beginning in 2004, Air Force officials said.

A B-52H Stratofortress carried the X-51A on its wing before it was released at 50,000 feet and accelerated up to Mach 4.8 in 26 seconds. As the scramjet climbed to 60,000 feet it accelerated to Mach 5.1.

The X-51 was also able to send back data before crashing into the ocean -- the kind of information now being used by scientists to engineer a more complete hypersonic vehicle.

"After exhausting its 240-second fuel supply, the vehicle continued to send back telemetry data until it splashed down into the ocean and was destroyed as designed," according to an Air Force statement at the time. "At impact, 370 seconds of data were collected from the experiment."

This Air Force the next-generation effort is not merely aimed at creating another scramjet but rather engineering a much more comprehensive hypersonic air vehicle, service scientists have explained.

Hypersonic flight requires technology designed to enable materials that can operate at the very high temperatures created by hypersonic speeds. They need guidance systems able to function as those speeds as well, Air Force officials have said.

The new air vehicle effort will progress alongside an Air Force hypersonic weapons program. While today's cruise missiles travel at speeds up to 600 miles per hour, hypersonic weapons will be able to reach speeds of Mach 5 to Mach 10, Air Force officials said.

The new air vehicle could be used to transport sensors, equipment or weaponry in the future, depending upon how the technology develops.

Also, Pentagon officials have said that hypersonic aircraft are expected to be much less expensive than traditional turbine engines because they require fewer parts.

For example, senior Air Force officials have said that hypersonic flight could speed up a five-hour flight from New York to Los Angeles to about 30 minutes. That being said, the speed of acceleration required for hypersonic flight may preclude or at least challenge the scientific

possibility of humans being able to travel at that speed – a question that has yet to be fully determined.