**Why has Purdue University become the center for developing future Hypersonics technology?**

China has for two decades funded and developed hypersonic technology and displayed her initial results in the summer of 2021. The fact that a country which did not get involved with advanced military technologies until the 21st Century has apparently gone ahead of both the Russians and us in hypersonics. One major reason China has succeeded is that it had recognized the need for such technology and generously funded their “hyper” project. A very successful economy has provided the Chinese with the required funding for a variety of 21st Century projects, including both military and critical civilian projects. This is now being demonstated in their progress in semiconductor chips development. A few years ago, Chinese President Xi Jinping announced funding of $1.4 billion for advance science development, which included funding for semiconductor work.

(Successful development with semiconductors will further improve her economic and military prowess and should be taken very seriously.)

In the summer of 2021 China’s test launch of test missile employing hypersonic technology was a wake up call for America to refocus and fund America’s hypersonic development and future systems.

After China’s initial hypersonics test missile, former President Donald Trump funded hypersonic development with $3.2 billion in the FY21 budget. All this new funding is not going directly to defense contractors, or even our Department of Defense research facilities, but to Perdue University.

This sounds surprising, but Purdue University, a land grant public university, is now, and will continue to be, in the center our hypersonic research. On the Purdue University campus is the” The Hypersonic Ground Testing Center (HGTC),” an independent, nonprofit consortium developed by the Purdue Research Foundation (PRF). The PRF has been quietly the center for hypersonic research for years, but now, working with our DoD will be on hyper drive to until we catch up with China (and Russia). For more information on the PRF, checkout TheDistrict.PRF.org

Note that on March 12th the Russians used a hyper-rocket to attack a military barracks in Ukraine.

Rolls Royce has joined the party on the Purdue campus to develop high temperature tolerant materials for the rocket engines that will power our future super-fast systems.

It certainly appears that our current and future destinies for Hypersonics will be centered at Purdue University.

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**Source:**

**“Can the U.S. Win the Hypersonics Race?,” *NYT, March 21 2022, p A11***

Last summer, following China’s successful launch of a test missile that circled the globe with impressive accuracy, the term “hypersonic” immediately became a part of the world’s lexicon. (It also made headlines again recently when Russia ran nuclear drills amid its siege of Ukraine.) The reason China had leapfrogged the U.S. in this technology? Its commitment to ground testing research facilities.

**The U.S., which had pioneered hypersonics, had ceded its leadership position because China had invested so heavily in testing infrastructure and research facilities**. In fact, in October, a leading Chinese researcher gave an online presentation in which he boasted that China’s research investment would soon put it 20 to 30 years ahead of other powers.

To respond to this challenge, the U.S. returned to the place where it did much of its fundamental hypersonics research decades ago when it dominated this area: Purdue University, which maintains one of the greatest concentrations of hypersonics researchers in the world.

**FIRST-OF-ITS-KIND FACILITY**

Technically, **the term “hypersonic” refers to flight at speeds of about five times the speed of sound (Mach 5).** But today when we talk about hypersonics, it’s really shorthand for hypersonic maneuvering systems, like a hypersonic cruise missile— **designed to fly, maneuver and operate at altitudes that make it particularly difficult for military defense to detect and stop.**

Recapturing the lead in hypersonics requires the U.S. to embrace new approaches. The Hypersonic Ground Testing Center (HGTC), an independent, nonprofit consortium developed by the Purdue Research Foundation (PRF), is a case study of the new kind of thinking that the expanding hypersonics arms race requires. HGTC is the first-of-its-kind U.S. facility to test hypersonic technologies.

“In this test facility, think of Purdue as a neutral host,” says Dr. Mung Chiang, executive vice president and dean of the engineering college at Purdue University. “Different defense companies will come here and share some common facilities, providing economies of scale in certain components, while being able to protect their intellectual property.”

HGTC’s capabilities will leverage **Purdue’s own research capabilities, including a 65,000-square-foot facility that will feature the nation’s first Mach 8 quiet wind tunnel, which collects data at higher speeds to provide insight into the physics around hypersonic travel, such as heat transfer**. It will also house a hypersonic pulse (HYPULSE) shock tunnel, providing a shockwave of high-temperature air to recreate specific hypersonic flight conditions, only the second of its kind in the U.S. The two wind tunnels will be complemented by an advanced manufacturing research center, all located in Purdue’s Zucrow Laboratories right next to HGTC.

According to Mark Lewis, executive director of the National Defense Industrial Association’s Emerging Technologies Institute (ETI), a nonpartisan think tank, and former director of defense research at the U.S. Department of Defense, HGTC will have the capabilities to solve problems that have long bedeviled the U.S., like designing engines for hypersonic vehicles.

The difficulty is not simply that a hypersonic vehicle travels at five times the speed of sound, but that at takeoff it begins at near zero velocity. “Building an engine that can power you from Mach 0 to Mach 5 is quite a challenge,” Lewis says. “We’re not exactly sure how to do it, but we have ideas, which involve combining multiple types of engines.”

**COMPETITIVE ADVANTAGE FOR U.S.: INNOVATION**

Aerospace engineer and space architect Wernher von Braun famously said: “One good test is worth a thousand expert opinions.”

The unique approach taken by the HGTC will allow the U.S. to exploit its competitive advantage of technical innovation by giving individual companies shared resources that will allow them to move quickly.

“People often ask, ‘Can’t you just develop hypersonics with computer simulations?’” Lewis says. “But computers can only simulate what we know. We need testing facilities so we can explore what we don’t know.”

“If today I wanted to test a Scramjet engine in the United States at full scale, I basically have only two alternatives,” Lewis continues. “I can either go to NASA Langley Research Center or to an Air Force tunnel, and those tunnels don’t operate at low speeds.” HGTC will provide the much-needed enhanced ground-testing capabilities.

HGTC is part of what Chiang calls “a hypersonics trifecta” that Purdue saw last summer. In August, the Hypersonics Summit 2.0, a joint effort between Purdue University, Purdue Research Foundation, Nine Twelve Institute and the National Defense Industry Association, was held. The summit featured participation from major leaders in hypersonics in the U.S.

In the same month, **Rolls-Royce, an aerospace engine manufacturing giant, announced it will expand its current footprint at the university as well. The new Rolls-Royce test facilities, which are adjacent to the campus**, will be used to develop high-altitude and hybrid-electric engines to power the next generation of U.S. military aircraft.

**The stakes are high and there is no time to delay, experts say. “There’s a practical reality that every time we did war games and analysis, if the United States did not have hypersonic capabilities in certain important scenarios, we didn’t win,”** Lewis says. “It was as simple as that.”

In addition, he notes China’s students flood technology conferences, in some cases presenting fundamental research, demonstrating the priority and investment China is applying to this area that the U.S. must match.

“They appear to have linked their industrial capabilities with their universities, developing multiple concepts and investing in the infrastructure that will make sure that they can succeed,” Lewis says. “They’re training their future workforce.”

**According to the U.S. government, China has conducted 20 times as many hypersonic tests as the United States in the last decade.** In response, the U.S. is ramping up its investment. The Pentagon’s fiscal year 2022 budget request for hypersonic research is $3.8 billion — up from $3.2 billion in the fiscal year 2021 request. Still, there is a long way to go.

**PARTNERING WITH BUSINESS**

Lewis says Purdue is perfectly situated to help the U.S. regain its standing in hypersonics because of the university’s and the PRF’s expertise in technology, as well as its expertise in working with business — a dynamic combination that is the only way to counter the efforts of China and our other competitors.

“ You look at a top research university, like Purdue University, and you see not just an aerospace department, but also electrical engineering, material science and all these other disciplines,” Lewis explains. “Hypersonics is a multidisciplinary area. If I’m going to build a hypersonic vehicle, by definition it’s going to travel really fast. That means it’s going to reach high altitudes and become hot due to friction with the air.”

That makes **hypersonics more than an aerodynamics challenge. It’s also a materials and controls challenge as well as a design challenge**. “A college of engineering that has multiple disciplines can fill an extremely important role in our national hypersonic efforts,” he says.

“I think they’ve created this environment where they attract the best and the brightest to conduct research in service to national defense,” Lewis continues, noting Purdue’s strong relationship with the Department of Defense, partnerships across Indiana in industry as well as state and federal government, and the support Purdue gets from government leadership. “They leverage assets across the state. It’s made for a really powerful combination.”