Here Come the Hypersonic Attack Planes!

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Like a bolt out of the blue, Lockheed Martin's renown Skunk Works publicly teased one of aviation's great snark hunts—revealing plans for a successor to the SR-71, the legendary Mach-3 reconnaissance plane designed with slide rules and retired when the millenials were born.

That 59-year old aircraft, originally developed as an uber-interceptor, still holds the record for fastest sustained supersonic flight at 2,100 miles per hour—much faster than a .50-caliber bullet.

But the new plane just announced, the SR-72, will fly twice as fast—so fast that at top speed the very air entering its engines *will be moving as fast as an SR-71.* Keeping combustion and thrust going under such conditions has been likened to lighting a cigar in a hurricane. The SR-72's planned ability to go from a standing start to Mach 6 and back again is a hat trick no one has been able to pull off.

Yet. An SR-72 demonstrator reportedly first appeared in plain view in California in July 2017.

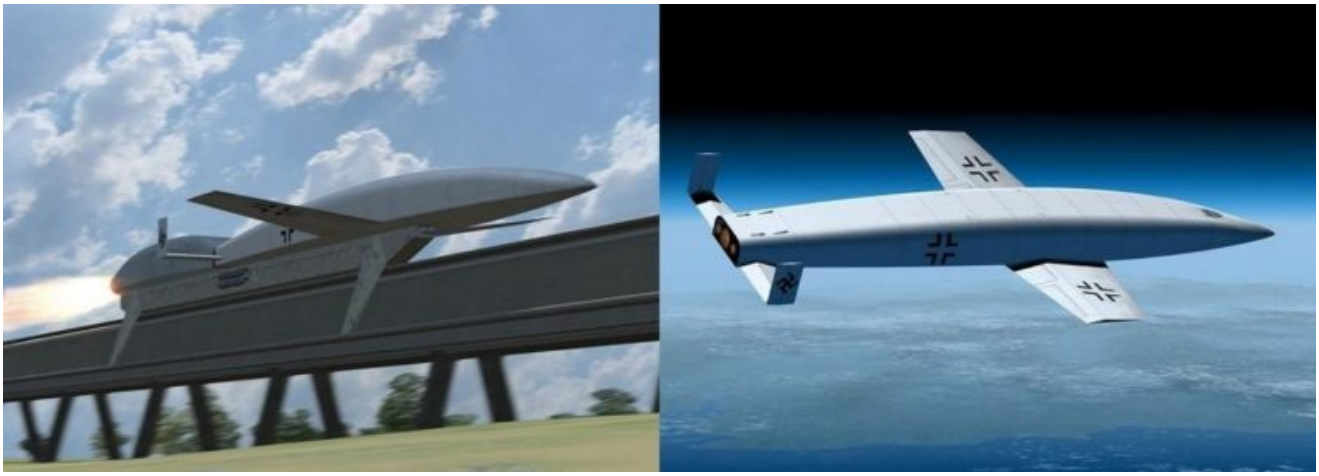
According to *Aviation Week*, Skunk Works has developed a way to run turbojet engines at high temperatures and power levels, high enough to push the SR-72 to Mach 2.5. The ramjet-scramjet second stage requires speeds above Mach 3 or 3.5 to operate, a "thrust chasm" which Lockheed Martin says it's solved … though it won't say how.

Turbojet? Ramjet? Scramjet? A turbojet spins many blades to compress and heat incoming air before setting it on fire and riding the resulting plume of hot expanding gas. A ramjet moves so fast that the air entering the engine is already hot and compressed enough to ignite the fuel. A scramjet—short for "supersonic combustion ramjet"—is just that, a ramjet where the incoming air is moving at supersonic speeds.

At hypersonic speeds there's no additional sonic boom, but the air piles up so fast along the aircraft's leading edges that they reach blast-furnace temperatures.

The SR-71 heated up so much due to the friction of its flight that its body panels fit together loosely on the ground and expanded snugly in flight.

But the breathtaking potential of hypersonic flight at Mach 5 and above has driven research forward for more than 70 years, in good times and bad, from Nazi wonder weapons to the *Right Stuff* and the Pacific pivot. Even before any man-made machine had reached supersonic speeds, the hypersonic domain enchanted some remarkable minds.



The Saenger Silverbird Antipodal Bomber. Josha Hildwine illustration

Das Flug aus die Silbervogel

Eugene Saenger first tackled the concept of a multi-thousand-mile-per-hour aircraft in his 1933 doctoral thesis; breakthrough work on cooling rocket engines by re-circulating cryogenic fuel through their walls brought him to the attention of Hitler's regime. Like Wernher von Braun, Saenger was encouraged to apply his radical ideas to building the Reich's might.

Von Braun's V-2 ballistic missile rammed home the frightful speed and power of supersonic weapons; the citizens of London and Antwerp got no warning of the huge missiles which fell three times faster than the sound they made. Saenger and colleague Irene Bredt's design, the *Silbervogel,* or "Silverbird" in English, might have brought stealthy death to New York and Chicago from halfway around the world.

The Silverbird, also known as the Antipodal Bomber, combined so many crazy ideas in one slick package that it's easy to understand its hold on imaginations so many years later, and why the Reich Air Ministry passed on building a prototype. The Nazi space plane's final design was a 91-foot-long plank-bellied lifting body sporting stubby wings, a monster 100-ton-thrust rocket motor and the fuel and liquid oxygen tanks to feed it.

Mounted on a giant rocket sled traveling down a two-mile-long monorail, the single pilot and his single (big) bomb would be hurled into the sky at nearly Mach 2 before the Silverbird's own rocket took it 70 miles up at Mach 19.

Seem familiar? It's because the system inspired a certain 1950s science-fiction movie.

As if the launch and boost phase weren't enough, this dieselpunk spaceplane's flight phase, the "skip-glide" technique, became a strategic warfighter's dream. Get an aerospace vehicle going high and fast enough, then drop it back into the atmosphere just so, and it will skip off the denser air like a tossed stone skipping off a quiet lake.

The skip then carries the vehicle back into space, friction slowing the vehicle with every skip. Saenger and Bredt calculated that the Silverbird could achieve a range of over 14,000 miles, nearly halfway to the Antipodes, by skip-gliding around the world from an initial boost in Germany.

Alas, later calculations revealed that the Silverbird would more than likely have suffered the fate of the Space Shuttle *Columbia* sometime during the flight.

Despite its magnificent technical sweetness, the Silverbird's mission was a mix of strategic bombing and pure terror. A four-ton bomb can do a lot of damage and the psychological impact of a continental American city being bombed out of the blue would have been tremendous. Planned strategic targets included aluminum smelters and aircraft plants.

Goering's air ministry dismissed the Saenger-Bredt concept and pursued other methods of attacking the United States. Joseph Stalin, however, took the concept seriously enough that after the war he ordered the NKVD to (unsuccessfuly) kidnap Saenger and Bredt from France.

Like many other aerospace rivalries, hypersonic research took off in both Cold War superpowers from its start under Hitler.

X-20 DynaSoar and X-15 pilot Neil Armstrong. Via Boeing and NASA

The right stuff

In the United States, flight at Mach 5-plus was fitted into the ongoing national effort that took Maj. Chuck Yeager through the sound barrier.

By the mid 1950s, the X-15 program had focused on designs, materials and protocols for hypersonic flight, and by the early 1960's X-15 pilots sporting astronauts' wings were routinely flying into space at Mach 6 from Edwards Air Force Base in California. As Tom Wolfe lyrically recounted in his classic work *The Right Stuff*, the X-15's winged, piloted approach soon gave way to the rounded capsules of Mercury, Gemini and Apollo.

The Air Force nearly achieved hypersonic flight half a century ago with the X-20 DynaSoar, the great might-have-been link between the Silverbird, the Space Shuttle and the SR-72. Designed to soar into space atop a Titan missile, orbit like a space capsule and land like a fighter plane, the X-20 fulfilled the Silverbird dream only to be killed off by Defense Secretary Robert McNamara.

Space Shuttle engineers in the 1970s relied on X-20 research in designing their spaceship. Today the recently-retired Space Shuttle is perhaps the most familiar hypersonic vehicle in the world. The Space Shuttles soared into space at Mach 23 before leaving the atmosphere—and flew "like bricks with wings" at hypersonic speeds during their fiery descents.

The tremendous heat experienced by the Shuttle during re-entry gives us a glimpse of the challenges facing the SR-72—the slightest crack in the surface can let in blowtorch heat and wind. And could destroy the vehicle and crew.

All successful hypersonic vehicles to date have been hurled forward by rocket power, from the WAC Corporal in 1949 to the X-51 Waverider this spring. Most recent U.S. hypersonic research has been focused on developing prompt long-range strike weapons in the form of air, sea and sub-launched payloads boosted up to cruise speed by rocket power.

Indeed, SpaceX's Falcon 1 rocket was funded in part to create a booster for hypersonic payloads.

And that's what makes the SR-72 really amazing. If Lockheed Martin and its partners call pull it off, flight will never be the same. Aerojet-Rocketdyne has a long distinguished pedigree in the propulsion field, ranging from 21-foot-wide solid fuel boosters and nuclear rockets to the Saturn V and Space Shuttle main engines.

An aircraft that can take off and land on standard runways, fly faster than a speeding bullet—and do so affordably—would quickly find its technology spreading throughout the aviation industry. The V-22 Osprey shrunk Iraq to the size of Rhode Island. The SR-72 and its kin could shrink the Indo-Pacific to the size of California.