

Alan Pierce

perceaj@techtoday.us; follow on Twitter @TechToday_us

Aviation Goes Hypersonic

The hypersonic airplanes discussed in this column will be able to fly from New York City to London, England, in under an hour. Since so much technology that is first developed for the military eventually finds its way into public use, it is possible that future passenger travel will take place at hypersonic speeds.

The speed of sound is called Mach 1 and equals 761.2 miles per hour. The fastest plane ever flown so far is the Lockheed Martin SR-71 Blackbird spy plane. Its maiden flight was December 22, 1964; it was retired as a spy plane in 1998. It flew at Mach 3.5, avoiding enemy military defenses by using its speed and flying altitude to outrun enemy defenses.

stays on schedule, it will be flying by the year 2030. (See Fig. 1.)

To build this aircraft, Lockheed Martin has been working with Aerojet Rocketdyne and DARPA (U.S.

plant on this aircraft will propel the airplane to Mach 6. The turbo-jet engine in the illustration is similar to the one that powered the SR-71, and it will take the plane from airfield to a speed of Mach 3. At this speed, the air flow going into the engine will be so compressed that it will be perfect air pressure to allow the airplane's ramjet engine to push propulsion up to Mach 6. Figure 2 shows both engines sharing the same air inlet and nozzle output. This plane is being designed to fly at very high altitudes



Fig. 1—Artist rendering of the SR-72

Lockheed Martin

Turbine-Based Combined Cycle Propulsion

Combined cycle means a turbine is combined with a ramjet to enable operation from static to hypersonic speeds (Mach 5+)

Turbine Engine

Thrust is provided by the turbine engine from takeoff up to about Mach 3

Common Inlet

Dual-Mode Ramjet

The Dual Mode Ramjet accelerates the vehicle up to hypersonic speeds

Common Nozzle

The turbine engine and ramjet are fed through a single inlet nozzle to significantly reduce drag

only within our atmosphere.

The second plane is designed as an air-breathing spaceplane. The Skylon Spaceplane will take off and land as an airplane with its engines in air-breathing mode. (See Fig. 3.) When the air becomes too thin to support engine combustion as it flies into space, the engines will switch over to rocket mode.

The Skylon is a joint project of Reaction Engines and the research laboratory of the U.S. Air Force. This craft does not appear to be as far along in development as the Lockheed Martin SR 72. However, its SABRE engine design has recently passed simulation testing by the AFRL (U.S. Air Force Research Laboratory) and a number of other research agencies. The Skylon SABRE (Synergetic Air Breathing Rocket Engine) burns hydrogen as fuel and carries its own oxygen. It needs the oxygen for all the flying time that it will do in rocket mode.

Alan Pierce, Ed.D., CSIT, is a technology education consultant. Visit www.technologytoday.us for past columns and teacher resources.

Fig. 2—The top image shows the outer shape of the aircraft; the lower image shows the placement of the different engines and other components within the body of the craft.

Two new engine and airplane designs have already proven in computer simulations that they will travel through the atmosphere at hypersonic speeds of Mach 6. The first, the Lockheed Martin SR-72, has been labeled by the press as "the son of Blackbird." If its development

Defense Advanced Research Projects Agency). Their goal is to build a spy plane that will fly through unfriendly airspace so fast—while taking pictures or shooting missiles—that it will be long gone by the time enemy defense systems get a chance to act.

Figure 2 shows how the power

Lockheed Martin



Fig. 3—Artist rendering of the spaceplane. The engine is cutaway to show its size in relation to the full spaceplane.

personal airplane, what do you think they would be able to see as they look out a window, looking in the direction the plane is flying? Looking straight down at the ground?

2. A mind tease posted on Facebook by the SIG Mfg. Model Airplane Co.: Imagine a 747 is sitting on a conveyor belt as wide and long as a runway. The conveyor belt is designed to exactly match the speed of the wheels, moving in the opposite direction. Can the plane take off? ©

Figure 4 shows what the SABRE engine will look like.

Flying at very high speeds, both the Lockheed Martin SR-72 and the Skylon Spaceplane will need control systems that can make snap decisions as objects to avoid appear in less time than a blink of an eye. Note that at Mach 6 the plane would be approximately passing over one mile of ground per every second of flight time.

Recalling the Facts

1. If a person was on board a hy-

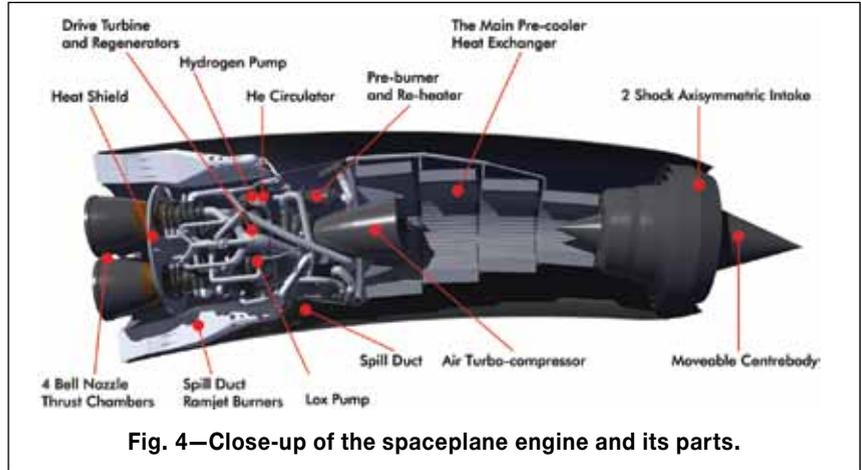


Fig. 4—Close-up of the spaceplane engine and its parts.

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