What a Blackbird Drinks

On the SR-71, Kelly Johnson once said, everything had to be invented—including the gas.

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An SR-71 taxis on the ramp. (NASA)

It would be hard enough to quench the thirst of an aircraft that can gulp 44,000 pounds of fuel in an hour if you could fill 'er up with the bargain brand. But the SR-71 is finicky, demanding fuel three times as expensive as the type used in airliners. The Blackbird uses a vintage 1970 military specification called MIL-T 38219, or Jet Propellant 7 ("JP-7" to its friends). The specification was exacting: It required that its odor "shall not be nauseating or irritating," and its color, "water-white, clean and bright" at room temperature

To meet the specs fuel maker Shell Oil invented a compound blend of kerosene distillates; hundreds of hydrocarbons such as paraffins, cycloparaffins or naphthenes, and olefins, with all but five percent of the aromatics removed in processing. Low aromatics mean a clean mixture, in the engineering sense: low levels of the impurities of sulfur, nitrogen, and oxygen. The JP-7 blend allows for "high thermal oxidative stability"; in other words, it's predictable at high

temperatures. Because low aromatics make for a poor lubricant, Shell added an agent (PWA-536) in a concentration of at least 200 parts per million to make the fuel slippery and lessen the wear on its fuel pump.

The heat generated on the SR-71's skin as it flies at Mach 3.2, radiates inward. The 80,000 pounds of JP-7, or about 12,000 gallons, needed a flash point high enough to avoid unintended combustion, partly because fuel was used as the primary heat sink to dissipate the high temperature in the airframe. One anecdote from Lockheed's Skunk Works tells of a crew chief tossing a match or a lit cigarette butt into a pail of fuel. Legend doesn't explain how such a man got a job as a crew chief, but does claim that JP-7 extinguished the flame. (Any low volatility fuel does the same thing.) Igniting the Blackbird's Pratt & Whitney J58s, required the intensely hot flash of triethylborane (TEB). Enough TEB was carried for 16 shots.

A traditional fuel tank liner would dissolve in JP-7, so the six main tanks themselves formed its exterior skin, and were not fully sealed against leaks, allowing for the expansion of the tanks from heat during high-speed flight. Photos of the Blackbird at low altitude often show fuel on its fuselage.

In flight, as each pound of JP-7 was burned, the cavity was filled with inert nitrogen gas pumped from the nose wheel well to replace the volatile vapors, and prevent the empty tanks from caving in as the Blackbird descended into higher air pressure.

Before flight, crew would count the drips per minute with a stopwatch and a chart to mark the location and to clean the hangar floor. JP-7 was extra-slippery after a rainfall, and wet tires on one SR-71 began to slide as it was taxiing in, causing its hangar crew to scramble for any handhold to prevent it (barely) from ramming a blast deflector.