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SKUNK WORKS MAGIC

How a handful of men broke the rules and created the world's most amazing high-tech weaponry.

BY JIM WILSON

Illustrations by Mike Machat, Mark McCandlish and Lockheed Martin Skunk Works.

Photos by Jim Wilson and Lockheed Martin Skunk Works.

The generals had botched it. Years before Pearl Harbor they had sneered at German plans for a new type of high-speed aircraft engine. Now in 1943, as the Allies began preparing for the D-Day invasion of France, intelligence reports revealed that the Nazis were ramping up production of a blistering fast fighter, a plane powered by the very same type of propellerless "jet" engine they had rejected. The War Department needed a miracle airplane and turned to the one man it could count on to deliver it in six months, Clarence L. Johnson. At age 33, "Kelly" Johnson had already established his reputation. His newest design, the twin-tailed, 400-mph P-38 Lightning, was the most

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maneuverable fighter—and arguably the most beautiful airplane—in the Allied force (see "Flying Battlewagons," May 1943, page 8). To counter the new German threat, the War Department wanted Kelly to build a plane that could fly 200 mph faster, literally pressing its nose against the sound barrier. The scrappy, one-time dockworker who was often described as W.C. Fields without a sense of humor, knew exactly what to do: He rented a circus tent.

Kelly pitched his tent on the sprawling Lockheed Aircraft complex in Burbank, Calif. Officially his shop was the Lockheed Advanced Development Projects Unit. The stench from a nearby plastic factory that wafted into the tent was so vile one of the engineers began answering the phone "skunk works," after the backwoods still in the then popular L'il Abner comic strip. Despite these less-than-ideal working conditions, Kelly's team of 23 design engineers and 30 shop mechanics delivered Lulu Belle, the prototype for the P-80 Shooting Star, in only 143 days. America had entered the jet age, more than a month ahead of schedule.

The war ended before the P-80, later designated the F-80, would fire its first shot in anger, against Soviet MiGs in Korea. Eventually Lockheed would build about 9000. Kelly's team moved to more permanent quarters, in a windowless bomber-production hangar. The foul smell that inspired the design team's name became a memory but the name lingered. At least until the lawyers for the L'il Abner comic strip caught wind of it. In deference to the comic strip, the "skunk works" was rechristened the Skunk Works.

Whatever the spelling, Kelly's Skunk Works is to aviation what Edison's Menlo Park was to electricity, a place where the daily pursuit of the impossible produces technologies indistinguishable from magic. That the Skunk Works thrived in those early years, let alone flourished to reach middle age, is all the more remarkable when you realize that its second and third major projects, the Saturn cargo plane and the XFV-1 vertical-takeoff naval fighter, were "absolute clunkers," according to Ben Rich,

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Now located in Palmdale, Calif., the Skunk Works has branched out to include developing stealthy missiles, low-observable unmanned aircraft like the DarkStar and reusable launch vehicles including the X-33. Its "black projects" remain a closely guarded secret.

Kelly's protégé and hand-picked successor. "The open secret in the company was that Kelly walked on water in the adoring eyes of CEO Robert Gross," Rich would later recall in his memoirs.

Building Planes

It was well-earned admiration. As a 23-year-old engineering student at the University of Michigan, Kelly had rescued Gross's investment in Lockheed by first spotting and then correcting a critical stability flaw in the twin-engine Lockheed Electra. Kelly's solution, a distinctive twin-tail, would become a Lockheed signature, appearing on the Constellation, P-38 and the Hudson bombers Lockheed built for the British Royal Air Force

(see "Uncle Sam's War Birds On World Frontiers," Jan. 1943, page 19).

Most everyone who worked with Kelly was quick to recognize his genius. Hall Hibbard, young Kelly's boss at Lockheed, recalled watching him convert the Electra into the Hudson bomber during a 72-hour marathon redesign session. "That damned Swede can actually see air," he later told Rich. When Kelly learned of Hibbard's remark he said it was the greatest compliment he had ever received.



KELLY JOHNSON



Kelly made no secret of how he worked his magic. He insisted his engineers get dirty on the shop floor. Working a lot like guys building hot rods in their garages, engineers and production mechanics created the hottest planes ever to cut through the air. This informal process produced the most important planes of the 20th century, including the Mach 2 F-104 Starfighter, U-2 and SR-71 spyplanes, and the stealthy F-117A. The Skunk Works' contributions to the creation of the F-22 Raptor and Joint Strike Fighter ensure its legacy in the shape of the Air Force of the 21st century. And its experimental stealth ship Sea Shadow means the Skunk Works will leave its mark on future navies as well.

Building Myths

Kelly crafted the Skunk Works reputation as carefully as he engineered his airplanes, memorializing the company's design philosophy as a set of 14 work rules. Followed to this day, they enshrine the virtues of speed,



simplicity and cooperation while banning the evils of paperwork and excessive management. Their spirit, if not their precise words, has been adopted by countless management gurus. Yet the two most important Skunk Works rules were never committed to paper. "All of the planes were Kelly's airplanes. And if a blue-suiter [Air Force officer] wore a star on his shoulder only Kelly was authorized to deal with him," Rich would later recall.

Kelly extended his "star" rule to contact with the CIA. He insisted upon being the sole contact with the intelligence community, which would provide the Skunk Works with its two biggest Cold War

successes, the high-flying U-2 and, later, the SR-71 spyplanes.

Resembling the aftermath of a head-on collision between a sail-plane and an airliner, the U-2 was the single most important intelligence tool of the Cold War. When it was ready to fly President Dwight D. Eisenhower considered its mission so critical to national security that he insisted on personally approving each of its overflights of the Soviet Union. The results were magnificent. "It really was as if we in the intelligence community had cataracts removed," recalls former CIA director Richard Helms. "The U-2 camera leapfrogged us into another dimension altogether." One of the first major coups was the discovery that a much-feared "bomber gap" between U.S. B-52 and Soviet Bison bombers didn't exist. U-2 photos revealed that the more than 100 Bison

counted flying overhead at a May Day military parade were in fact a fleet of 30 flying in a circle.

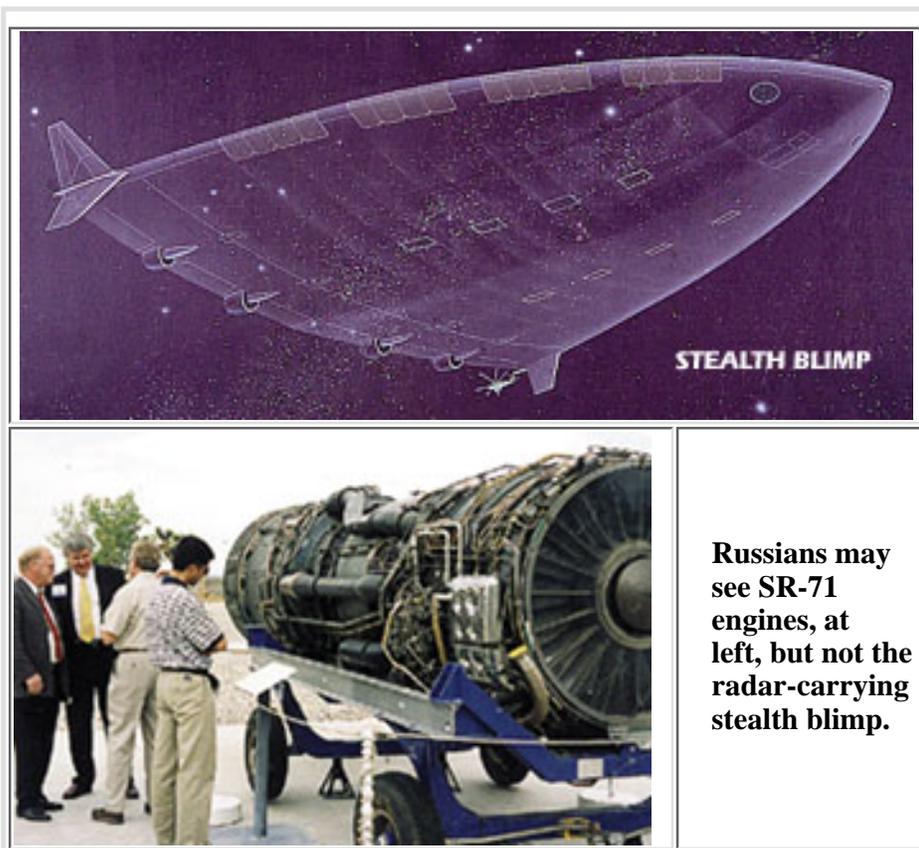
Suntan

Before overflights of the Soviet Union officially ended as the result of the downing of Francis Gary Powers, the folded-optics camera inside the U-2's "Q-bay" would capture an image that would spur the Skunk Works to design the most impressive plane it never built, the CL-400. The unbuilt plane would also spawn one of its most enduring mysteries about what really takes place behind closed hangar doors.

Intelligence work is largely a hunt for anomalies. During the height of the Cold War no anomaly was more ominous than the release of a scientist from the gulag, the vast network of Soviet labor camps. When Pyotr Kapitsa, an expert on low-temperature gases arrested in 1946, suddenly found himself transferred to a Soviet research institute, inquiring minds at the CIA wanted to know why. Photos of hydrogen liquefaction plants taken by U-2 overflights offered a frightening possibility: Kapitsa had been "rehabilitated" so that he could work on the powerplant for a hydrogen-powered space plane. During the last days of World War II, just such a plane had been proposed as a means of bombing New York City from flights originating in Germany. Little evidence of such a craft was ever found after the war. The possibility that the Soviets had carried it all off lock, stock and barrel was not beyond reason.

Terrified at the prospect of Soviet spyplanes flying over U.S. airspace with the impunity that the U-2 crossed Mother Russia, the Skunk Works found itself with \$96 million and an assignment to build an ultrasecret hydrogen-powered space plane to counter the new red menace.

For some time before receiving the go-ahead for Project Suntan, Kelly had been fascinated with the idea of burning -350°F hydrogen in a modified jet engine. In theory, such a Mach 2 craft could effortlessly skim the atmosphere at 100,000 ft. The



Russians may see SR-71 engines, at left, but not the radar-carrying stealth blimp.



Skunk Works geared up to provide the Air Force with a complete package, including a liquid hydrogen production plant and refueling planes. Literally overnight the Skunk Works became the world's largest producer of liquid hydrogen, creating 200 gal. a day.

Meanwhile, the CL-400, as the Suntan hydrogen aircraft was designated, began to take shape as a delta-wing vacuum bottle as big as a pair of B-52s. Encouraged by

initial design work, Rich recalled that Kelly ordered 2 1/2 miles of aluminum extrusions. Pratt & Whitney was set to work modifying engines to burn hydrogen. A guidance system was ordered from MIT. And then Kelly spotted the critical flaw.

The CL-400 could fly. There was no question of that. What it couldn't do was fly faster or farther than a kerosene-burning jet plane. Hydrogen offered no technological edge. Kelly bit the bullet, and convinced the Air Force to take back the unspent \$90 million. As for the Soviet plane, it never materialized. It seems hydrogen-fuel expert Kapitsa had been freed to work on another project that had somehow escaped the CIA's notice, the launch of Sputnik, the world's first successfully orbited artificial satellite. In 1978, he would win the Nobel Prize.

Aurora

The CL-400 vanished from the Skunk Works but the mythology surrounding a liquid hydrogen spyplane remained and in time would grow to become one of the great Skunk Works mysteries, Aurora. The Air Force and Lockheed insist Aurora is a code name for the company's work on its entry in the B-2 stealth bomber design competition, which was won by Northrop Aircraft.

Those who chase mystery aircraft point to two facts that suggest there may be more to the story. There have, they claim, been repeated sightings of a mystery craft of the CL-400-like proportions moving at high speed. There is also documentation of a NASA-financed project that overcame the technical



JACK GORDON

roadblocks that caused Suntan to stumble. In the early 1970s Gerald Rosen, a professor of physics at Philadelphia's Drexel University and one of the highest paid theoretical physicists in the United States, was contracted by NASA to determine whether it would be possible to store hydrogen as individual atoms rather than as molecules. His calculations predicted it was not only possible, but that so much fuel could be stored in a small space that the Apollo astronauts could have traveled to the moon in a rocket the size of a pickup truck. And so, official denials ignored, Aurora remains a lively topic for speculation.

The Fastest Plane



Despite the termination of Suntan, the Skunk Works got to build a fast, high-flying spyplane, the SR-71 Blackbird. Designed for Mach 3 plus flight (see "The Blackbird Is Back," June 1991, page 27), the SR-71 holds a slew of records that are

not likely to be broken for decades to come. Like the U-2, the SR-71 also began as a CIA project. And like the U-2, its role was obsoleted by technology, in this case American technology in the form of CIA and National Reconnaissance Office spy satellites. Today, most SR-71s, and their predecessor A-12s, are featured attractions at air museums. NASA continues to operate one SR-71 for environmental research. A second, operated by the Air Force, is used from time to time in technology demonstration experiments, according to military sources.

It was a far different fate than Kelly had envisioned for the SR-71. Much as he had adapted the Electra to become the British Hudson bomber, Kelly envisioned manufacturing fleets of the SR-71 specially modified as bombers, fighters and missile launchers. The government rejected the idea and, in a decision that will live in infamy for aviation enthusiasts for centuries to come, ordered the Skunk Works to destroy all SR-71 tooling.

Before being killed in its prime, the SR-71 took part in an experiment that would pave the Skunk Works' entry into the next frontier of high-altitude surveillance, Tagboard. The project tested the feasibility of using the SR-71 to launch a high-speed, high-altitude drone, the D-21, deep into enemy terrain. After a series of tries, including one that ended in the loss of a plane and its pilot, Tagboard was canceled.

Combining the lessons learned from Tagboard with the stealth technology it would later develop for Have Blue, the prototype for the F-117A (see "Black Jet," July 1990, page 43), the Skunk Works would work with Boeing to develop DarkStar. Using this low-observable, high-altitude, long-endurance unmanned aircraft, the Air Force will be able to undertake reconnaissance missions too far into hostile terrain for manned aircraft and too expensive for satellites.

Future Planes

Changing times have rendered the legendary planes of the Skunk Works militarily obsolete. Kelly and Rich have passed on. In May 1995, following the merger of Lockheed and Martin Marietta, the new Lockheed Martin company spun off the Skunk Works as a separate Lockheed operation, based in Palmdale, Calif. Today, a new generation of designers, plane builders and test pilots

under the leadership of president Jack Gordon carries on the best of the old Skunk Works traditions. Later this year they will literally blast the Skunk Works into the 21st century, with the launch of the X-33. A prototype for Venture Star, a possible replacement for NASA's space shuttle, the X-33 itself is being considered as a testbed for a future military space plane. Tales of mystery craft continue. There have been scores of sightings of a 1000-ft.-long stealth blimp that supposedly carries a massive phased array radar. The craft is said to disguise itself by using "optical stealth" technology that creates an image of a floating star field.

By their nature, the type of "black projects" undertaken by the Skunk Works always have and always will be secret. What PM has learned through its conversations with company executives and test pilots and visits to nonrestricted parts of the Skunk Works is only as much as the company and government are willing to share. It is certain that there is far more to the Skunk Works story than can now be told. Looking at the tall white hangars gleaming in the high desert sun, we can't help but wonder what 21st century wonders are taking shape inside.

