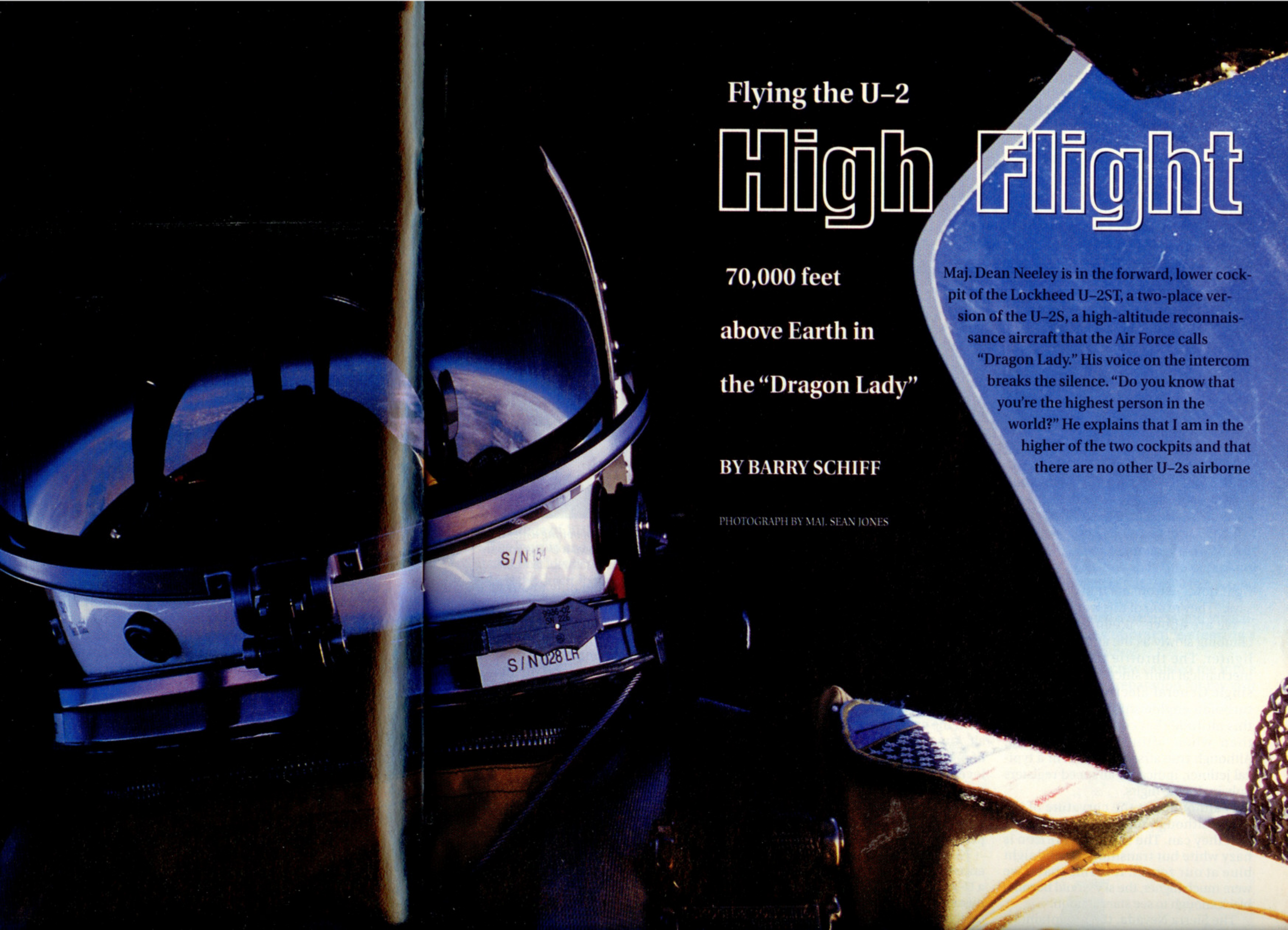


Flying the U–2

High Flight

70,000 feet above Earth in the "Dragon Lady"

BY BARRY SCHIFF

PHOTOGRAPH BY MAJ. SEAN JONES

Maj. Dean Neeley is in the forward, lower cockpit of the Lockheed U–2ST, a two-place version of the U–2S, a high-altitude reconnaissance aircraft that the Air Force calls "Dragon Lady." His voice on the intercom breaks the silence. "Do you know that you're the highest person in the world?" He explains that I am in the higher of the two cockpits and that there are no other U–2s airborne

After decompression to 73,000 feet in the altitude chamber, the author's spacesuit is fully inflated (above). Note the beaker of boiling water in the chamber (above). Wearing virtual-reality goggles, the author steers a parachute landing (top left). Practice is required to exit a U–2 gracefully while wearing a spacesuit (above left).

right now. "Astronauts don't count," he says. "They're *out* of this world."

We are above 70,000 feet and still climbing slowly as the aircraft becomes lighter. The throttle has been at its mechanical limit since takeoff, and the single General Electric F118-GE-101 turbofan engine sips fuel so slowly at this altitude that consumption is less than when idling on the ground. Although true airspeed is that of a typical jetliner, indicated airspeed registers only in double digits.

I cannot detect the curvature of the Earth, although some U–2 pilots claim that they can. The sky at the horizon is hazy white but transitions to midnight blue at our zenith. It seems that if we were much higher, the sky would become black enough to see stars at noon.

The Sierra Nevada, the mountainous spine of California, has lost its glory, a mere corrugation on the Earth. Lake Tahoe looks like a fishing hole, and rivers have become rivulets. Far below, "high flying" jetliners etch contrails over Reno, Nevada, but we are so high above these aircraft that they cannot be seen.

I feel mild concern about the bailout light on the instrument panel and pray that Neeley does not have reason to turn it on. At this altitude I also feel a sense of insignificance and isolation; earthly concerns seem trivial. This flight is an epiphany, a life-altering experience.

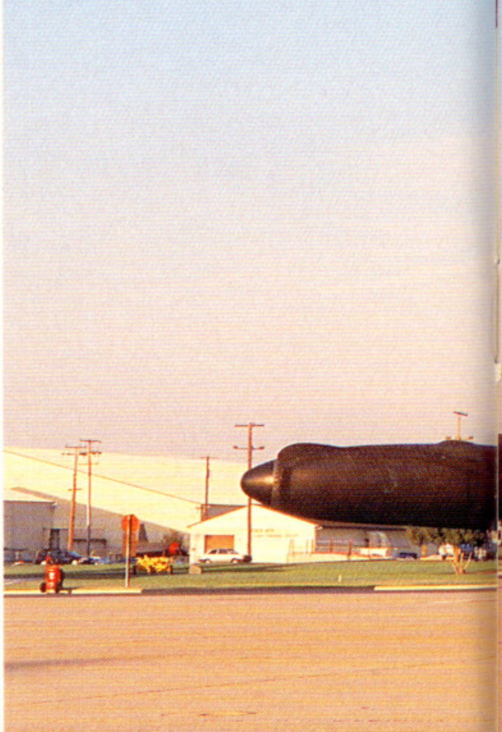
It is difficult to detect air noise through the helmet of my pressure suit. I hear only my own breathing, the hum of avionics through my headset, and—inexplicably—an occasional, shallow moan from the engine, as if it were gasping for air. Atmospheric pressure is only an inch of mercury, less than 4 percent of sea-level pressure. Air density and engine power are similarly low. The stratospheric wind is predictably light, from the southwest at 5 knots, and the outside air temperature is minus 61 degrees Celsius.

Neeley says that he has never experienced weather that could not be topped in a U–2. I am reminded of the classic transmission made by John Glenn during Earth orbit in a Mercury space capsule: "Another thousand feet, and we'll be on top."

Although not required, we remain in contact with Oakland Center while in the Class E airspace that begins at Flight Level 600. The U–2's Mode C transponder, however, can indicate no higher than FL600. When other U–2s are in the area, pilots report their altitudes, and ATC keeps them separated by 5,000 feet and 50 miles.

Our high-flying living quarters are pressurized to 29,500 feet, but 100-percent oxygen supplied only to our faces lowers our physiological altitude to about 8,000 feet. A pressurization-system failure would cause our suits to instantly inflate to maintain a pressure altitude of 35,000 feet, and the flow of pure oxygen would provide a physiolog-

The flat black paint makes a U–2 difficult to detect visually and by radar.



PHOTOGRAPHY BY MIKE FIZER

ical altitude of 10,000 feet.

The forward and aft cockpits are configured almost identically. A significant difference is the down-looking periscope/driftmeter in the center of the forward instrument panel. It is used to precisely track over specific ground points during reconnaissance, something that otherwise would be impossible from high altitude. The forward cockpit also is equipped with a small side-view mirror extending into the air stream. It is used to determine if the U–2 is generating a telltale contrail when over hostile territory.

Considering its 103-foot wingspan and resultant roll dampening, the U–2 maneuvers surprisingly well at altitude; the controls are light and nicely harmonized. Control wheels (not sticks) are used, however, perhaps because aileron forces are heavy at low altitude. A yaw string (like those used on sailplanes) above each canopy silently admonishes those who allow the aircraft to slip or skid when maneuvering. The U–2 is very much a stick-and-rudder airplane, and I discover that slipping can be avoided by leading turn entry and recovery with slight rudder pressure.

When approaching its service ceiling, the U–2's maximum speed is little more than its minimum. This marginal difference between the onset of stall buffet and Mach buffet is known as the *coffin corner,* an area warranting caution. A stall-spin sequence can cause control loss from which recovery might not be possible when so high, and an excessive Mach number can compromise structural integrity. Thankfully, an autopilot with Mach hold is provided.

The U–2 has a fuel capacity of 2,915 gallons of thermally stable jet fuel distributed among four wing tanks. It is unusual to discuss turbine fuel in gallons instead of pounds, but the 1950s-style fuel gauges in the U–2 indicate in gallons. Most of the other flight instruments seem equally antiquated.

Training at 'The Ranch'

Preparation for my high flight began the day before at Beale Air Force Base (a.k.a. The Ranch), which is north of Sacramento, California, and was where German prisoners of war were interned during World War II. It is home to the 9th Reconnaissance Wing, which is responsible for worldwide U–2 operations, including those aircraft based in Cypress; Italy; Saudi Arabia; and South Korea.

After passing a physical exam (whew!), I took a short, intensive course in high-altitude physiology and use of the pressure suit. The 27-pound Model S1034 "pilot's protective assembly" is manufactured by David Clark (the headset people) and is the same as the one used by astronauts during shuttle launch and reentry.

After being measured for my $150,000 spacesuit, I spent an hour in the egress trainer. It provided no comfort to learn that pulling up mightily on the handle between my legs would activate the ejection seat at any altitude or airspeed. When the handle is pulled, the control wheels go fully forward, explosives dispose of the canopy, cables attached to spurs on your boots pull your feet aft, and you are rocketed into space. You could then free fall in your inflated pressure suit for 54,000 feet or more. I was told that "the parachute opens automatically at 16,500 feet, or you get a refund."

I later donned a harness and virtual-reality goggles to practice steering a parachute to landing.

After lunch, a crew assisted me into a pressure suit in preparation for my visit

Maj. Dean Neeley briefs the author on their upcoming flight over California and Nevada (above left). Final adjustments are made to the author's spacesuit before the flight (above center).

to the altitude chamber. There I became reacquainted with the effects of hypoxia and was subjected to a sudden decompression that elevated the chamber to 73,000 feet. The pressure suit inflated as advertised and just as suddenly I became the Michelin man. I was told that it is possible to fly the U–2 while puffed up but that it is difficult.

A beaker of water in the chamber boiled furiously to demonstrate what would happen to my blood if I were exposed without protection to ambient pressure above 63,000 feet.

After a thorough preflight briefing the next morning, Neeley and I put on long johns and UCDs (urinary collection devices), were assisted into our pressure suits, performed a leak check (both kinds), and settled into a pair of reclining lounge chairs for an hour of breathing pure oxygen. This displaces nitrogen in the blood to prevent decompression sickness (the bends) that could occur during ascent.

During this "pre-breathing," I felt as though I were in a Ziploc bag-style cocoon and anticipated the possibility of claustrophobia. There was none, and I soon became comfortably acclimatized to my confinement.

We were in the aircraft an hour later. Preflight checks completed and engine started, we taxied to Beale's 12,000-foot-long runway. The single main landing gear is not steerable, differential braking is unavailable, and the dual tailwheels move only 6 degrees in each direction, so it takes a lot of concrete to maneuver on the ground. Turn radius is 189 feet, and I had to lead with full rudder in anticipation of all turns.

We taxied into position and came to a halt so that personnel could remove the safety pins from the outrigger wheels (called *pogos*) that prevent one wing tip

"Dragon Lady" is elegant in the air but seems ungainly when on the ground and out of its element.

Maj. Dean Neeley (at left, above right) and the author "pre-breathe" pure oxygen to displace nitrogen in the blood prior to flight in the U–2.

or the other from scraping the ground. Lt. Col. Greg "Spanky" Barber, another U–2 pilot, circled the aircraft in a mobile command vehicle to give the aircraft a final exterior check.

I knew that the U–2 is overpowered at sea level. It has to be for its engine, normally aspirated like every other turbine engine, to have enough power remaining to climb above 70,000 feet. Also, we weighed only 24,000 pounds (maximum allowable is 41,000 pounds) and were departing into a brisk headwind. Such knowledge did not prepare me for what followed.

The throttle was fully advanced and would remain that way until the beginning of descent. The 17,000 pounds of thrust made it feel as though I had been shot from a cannon. Within two to three seconds and 400 feet of takeoff roll, the wings flexed, the pogos fell away, and we entered a nose-up attitude of almost 45 degrees at a best-angle-of-climb airspeed of 100 kt. Initial climb rate was 9,000 fpm.

We were still over the runway and through 10,000 feet less than 90 seconds from brake release. One need not worry about a flameout after takeoff in a U–2. There either is enough runway to land straight ahead or enough altitude (only 1,000 feet is needed) to circle the airport for a dead-stick approach and landing.

The bicycle landing gear creates little drag and has no limiting airspeed, so there was no rush to tuck away the wheels. (The landing gear is not retracted at all when in the traffic pattern shooting touch and goes.)

We passed through 30,000 feet five minutes after liftoff and climb rate steadily decreased until above 70,000 feet, when further climb occurred only as the result of fuel burn.

On final approach

Dragon Lady is still drifting toward the upper limits of the atmosphere at 100 to 200 fpm and will continue to do so until it is time to descend. It spends little of its life at a given altitude.

Descent begins by retarding the throttle to idle and lowering the landing gear. We raise the spoilers, deploy the speed brakes (one on each side of the aft fuselage), and engage the gust alleviation system. This raises both ailerons 7.5 degrees above their normal neutral point and deflects the wing flaps 6.5 degrees upward. This helps to unload the wings and protect the airframe during possible turbulence in the lower atmosphere.

Gust protection is needed because the Dragon Lady is like a china doll; she cannot withstand heavy gust and maneuvering loads. Strength would have required a heavier structure, and the U–2's designer, Clarence "Kelly" Johnson, shaved off as much weight as possible—which is why there are only two landing gear legs instead of three. Every pound saved resulted in a 10-foot increase in ceiling.

With everything possible hanging and extended, the U–2 shows little desire to go down. It will take 40 minutes to descend to traffic pattern altitude, but we needed only half that time climbing to altitude.

During this normal descent, the U–2 covers 37 nm for each 10,000 feet of altitude lost. When clean and at the best glide speed of 109 kt, it has a glide ratio of 28:1. It is difficult to imagine ever being beyond glide range of a suitable airport except when over large bodies of water or hostile territory.

Because there is only one fuel quantity gauge, and it shows only the total remaining, it is difficult to know whether fuel is distributed evenly, which is important when landing a U–2. A low-altitude stall is performed to determine which is the heavier wing, and some fuel is then transferred from it to the other.

We are on final approach with flaps at 35 degrees (maximum is 50 degrees) in a slightly nose-down attitude. The U–2 is flown with a heavy hand when slow, while being careful not to overcontrol. Speed over the threshold is only 1.1 V_{SO} (75 kt), very close to stall. More speed would result in excessive floating.

I peripherally see Barber accelerating the 140-mph, stock Chevrolet Camaro along the runway as he joins in tight formation with our landing aircraft. I hear him on the radio calling out our height (standard practice for all U–2 landings). The U–2 must be close to normal touchdown attitude at a height of one foot before the control wheel is brought firmly aft to stall the wings and plant the tailwheels on the concrete. The feet remain active on the pedals, during which time it is necessary to work diligently to keep the wings level. A roll spoiler on each wing lends a helping hand when its

respective aileron is raised more than 13 degrees.

The aircraft comes to rest, a wing tip falls to the ground, and crewmen appear to reattach the pogos for taxiing.

A U-2 pilot driving in formation with a landing U-2 calls out height above touchdown (above). U-2 pilots of the 9th Reconnaissance Wing celebrate the author's flight (below).

Landing a U-2 is notoriously challenging, especially for those who have never flown taildraggers or sailplanes. It can be like dancing with a lady or wrestling a dragon, depending on wind and runway conditions. Maximum allowable crosswind is 15 kt.

The U-2 was first flown by Tony Levier in August 1955, at Groom Lake (Area 51), Nevada. The aircraft was then known as Article 341, an attempt by the Central Intelligence Agency to disguise the secret nature of its project. Current U-2s are 40 percent larger and much more powerful than the one in which Francis Gary Powers was downed by a missile over the Soviet Union on May 1, 1960.

The Soviets referred to the U-2 as the "Black Lady of Espionage" because of its spy missions and mystique. The age of its design, however, belies the sophistication of the sensing technology carried within. During U.S. involvement in Kosovo, for example, U-2s gathered and forwarded data via satellite to Intelligence at Beale AFB for instant analysis. The results were sent via satellite to battle commanders, who decided whether attack aircraft should be sent to the target. In one case, U-2 sensors detected enemy aircraft parked on a dirt road and camouflaged by thick, overhanging trees. Only a few minutes elapsed between detection and destruction. No other nation has this capability.

The U-2 long ago outlived predictions of its demise. It also survived its heir apparent, the Lockheed SR-71 Blackbird. The fleet of 37 aircraft is budgeted to operate for another 20 years, but this could be affected by the evolution and effectiveness of unmanned aircraft.

After returning to Earth (physically and emotionally), I am escorted to the Heritage Room, where 20 U-2 pilots join to share in the spirited celebration of my high flight. Many of them are involved in general aviation and some have their own aircraft.

The walls of this watering hole are replete with fascinating memorabilia about U-2 operations and history. Several plaques proudly list all who have ever soloed Dragon Lady. This group of 670 forms an elite and unusually close-knit cadre of dedicated airmen. □

For more information on the U-2, see AOPA Online (www.aopa.org/pilot/links.shtml). The author expresses his gratitude to Col. Eric Ströberg, Lt. Col. Greg "Spanky" Barber, Maj. Dean Neeley, and the men and women of the 9th Reconnaissance Wing for graciously sharing their time and expertise. Visit the author's Web site (www.barryschiff.com).