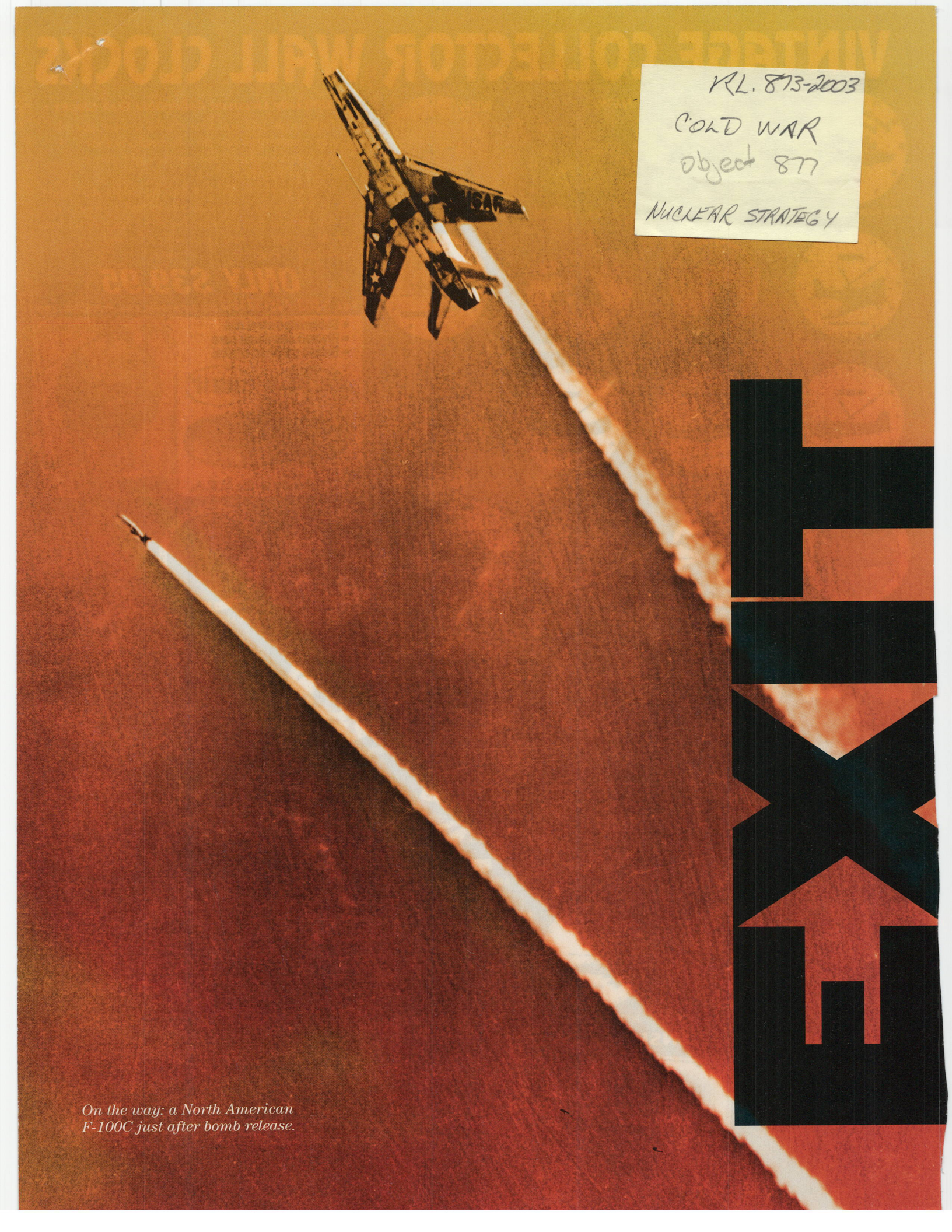


EXIT

On the way: a North American F-100C just after bomb release.

STRATEGY

PULL UP, DROP, RUN FOR IT.

BY MARSHALL MICHEL

AT AN AIR FORCE FIREPOWER DEMONSTRATION HELD at Eglin Air Force Base in Florida on May 7, 1957, a silvery swept-wing Boeing B-47 Stratojet bomber roared in low at 500 mph before a crowd of more than 3,000 people. The six-jet bomber tore past the front of the reviewing stand, which was filled with high-ranking military officers and 11 state governors, then pulled up into a steep climb and continued up, up, until it was almost standing on its tail. The bomb bay doors snapped open and an orange practice bomb, trailing smoke from a pyrotechnic device in its tail, arced up and away from the bomber.

The audience watched transfixed as the B-47 continued until it was upside down at the top of a half loop. Then, still inverted, it started down the back side of the loop, rolled right side up, and dove away in the direction from which it had come. This was the first public demonstration of a B-47 performing a new mode of nuclear weapons delivery that had been developed far from public view five years earlier. Not just the B-47 but a long list of tactical fighter-bombers would employ the startling new maneuver, which was called toss bombing.

In 1952 the Strategic Air Command had identified more major targets in the Soviet Union than it had heavy bombers to deliver nuclear weapons; because of the aircraft shortage, many targets would go untouched—at least in a first wave of an attack. But about that time two technologies came along that made it possible for short-range fighters to deliver nuclear bombs: mid-air refueling and nuclear weapons that were dramatically lighter in weight than the ones developed during World War II.

SAC had several wings of Republic F-84 Thunderjet fighters, and in July 1952, it assigned some of these units to "strike with atomic munitions…enemy airdromes, guided missile launching sites, key radar control centers, and other suitable targets deep in enemy territory," according to a July 19 message from U.S. Air Force Headquarters. SAC planned to fly F-84s from the United States to Europe, refueling along the way. Once at their European bases, they would take on nuclear weapons and fly to their Soviet targets. The F-84s lacked precision navigation equipment and bombsights, so SAC ordered the pilots to train in low-level navigation. Each pilot got a file folder with details about each target to commit to memory. They would fly to their targets at low altitude—just hundreds of feet off the ground, well below the persistent European overcast. The units practiced navigating over routes in the United States and Europe with terrain similar to that of their assigned wartime targets; they used visual navigation techniques based on time, compass heading, and references such as rivers, cities, roads, and bridges. The fighter-bombers' low altitude had an important if unanticipated benefit: They'd be beneath Soviet radar coverage.

But the low approach to the target also presented a major problem. How could the fighters escape the massive blast, flash, and radiation effects of their own nuclear weapons? SAC's big bombers dropped their bombs from 30,000 feet or higher and turned away, so by the time the bombs detonated they were a safe distance. When a fighter-bomber made a low-level delivery, it did not have enough time to escape before the bomb detonated.

Although few detailed unclassified records of the roots of the program can be found, this much is known: To solve the problem, SAC, working with the Air Research and Development Command, embarked on a program called Project Back Breaker. The attacking airplane would approach the target at high speed and low altitude, then climb sharply and release the bomb so that it was lofted, or tossed, high in the air (about 18,000 feet above the ground, it was calculated). While the bomb was arcing upward, the attacker would continue up into a half-roll, half-loop that formed the first half of a maneuver called a Cuban Eight, and then escape the way it came.

To deliver the bomb relatively accurately, ARDC developed a system known as the Low Altitude Bombing System (LABS), which was a set of gyros and a rudimentary mechanical computer linked to a fist-size, circular cockpit instrument, the dive-and-roll indicator. The equipment weighed only a few pounds, was easily installed, and al-

USAF MUSEUM

most immediately available, and it could consistently hit a circle with a radius of 1,500 feet. With nuclear weapons, as with horseshoes, close counts.

Operation was simple. The pilot had a set of very precise maps from which he selected a visual point on the ground, called an initial point (IP), close to the target. The pilot loaded the time from the IP to the target into the LABS prior to the mission. After takeoff, he visually navigated to the IP, and the instant he crossed over it and began his run to the target, he pressed the bomb release "pickle" button to activate the LABS, then fixed his attention on the dive-and-roll indicator.

The dive-and-roll indicator had two needles, a horizontal one for pitch and a vertical one for direction. When the aircraft reached the calculated release point, about two and a half miles from the target, the needles cued the pilot to climb and guided him to the release point. Les Frazier, an F-100 pilot who flew many LABS missions, describes the sequence this way: "Just prior to the pull-up point, the horizontal needle on the LABS dropped down, and the pilot pulled back on the stick to bring the needle back to level. The horizontal needle led the aircraft into a 4-G climb in two seconds, while the vertical needle showed the course. Keeping both needles centered kept the aircraft lined up, and for several seconds this was the pilot's entire world—it was about as easy as pushing an oyster into a slot machine. The bomb released automatically with a loud *wham* that could be heard in the cockpit, and the airplane would oscillate from side to side as the weapon was blown clear."

In November 1952, SAC had two of its F-84 wings test two different LABS release methods. The first was the basic toss, described above. The advantage of the basic toss was that there was no need to fly over a heavily defended target. But it required a visual landmark close to the target and forced the attacker to follow a fixed course to overfly that landmark.

The second type of release was dubbed the "over the shoulder" maneuver. The attacker flew directly over the target and pulled up into a loop, and as the fighter approached the top of the loop, the LABS automatically released the bomb. After release, the pilot continued the loop as the bomb kept climbing. Well before the bomb reached the apex of its climb, the attacker started back down, rolled upright, and headed back in the opposite direction to escape the blast. The loop over the target made the fighter very vulnerable to close-in defenses, but as long as the target could be seen, the fighter could approach it from any angle, so the method was more flexible tactically than the basic toss.

SAC chose the over-the-shoulder maneuver as the preferred means of delivery, with the toss method an alternative if useable landmarks were available. In January 1953, just three months after the tests began, SAC's fighters officially became part of the strategic force assigned to strike targets in the Soviet Union. Beginning in August 1953, SAC regularly deployed its nuclear-capable F-84s to Europe, refueling en route, and by 1955 it had built this force to over 550 fighters organized into six wings.

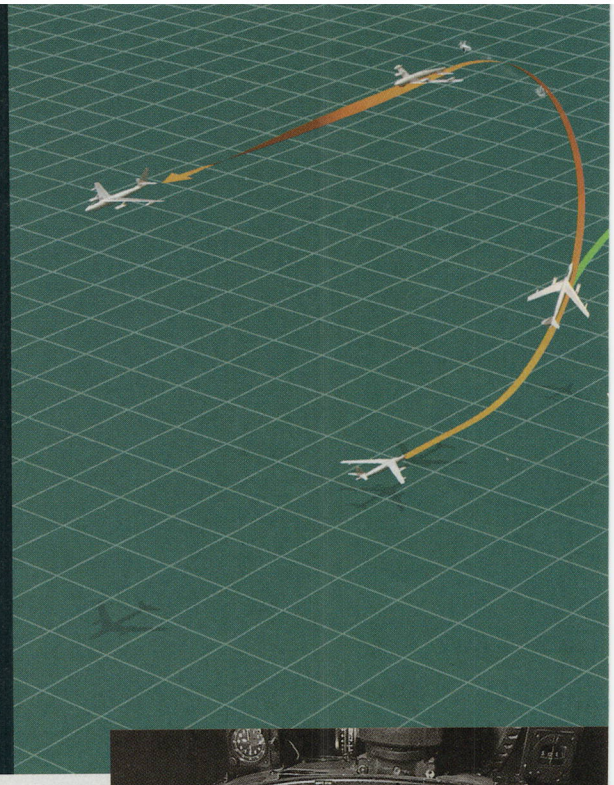
But throughout the early 1950s SAC still considered the Boeing B-47 bomber its primary nuclear weapons delivery aircraft. When it entered operational service, its six jet engines and thin swept wings gave it speed and high-altitude capabilities that enabled it to outrun any fighter in the world. By early 1954, though, it was clear that it was only a matter of time before Soviet surface-to-air missiles and MiGs with heat-seeking air-to-air missiles would shut the B-47 out of the high-altitude environment. The bombers would need new tactics to reach their targets. Fortunately, the B-47 had not only high-altitude performance and speed but also excellent maneuverability.

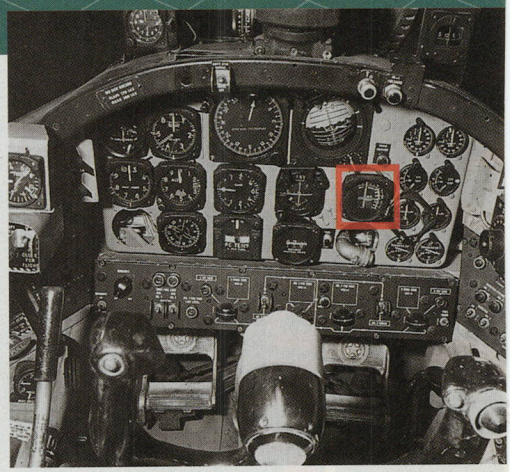
Lieutenant Colonel Doug Nelson of SAC devised the low-level penetration and toss tactic for the B-47 and reportedly startled the SAC staff when he briefed them on the technique. Nonetheless, in early August 1956, SAC asked Boeing to look into the matter, and Dick Taylor was chosen as the company's test pilot for the project.

After practicing with barrel rolls, Taylor first tried the half-loop, half-roll of the Cuban Eight in the big jet bomber in October 1956. He remembers, "Forty seconds—that's the time it took to put

How It Worked

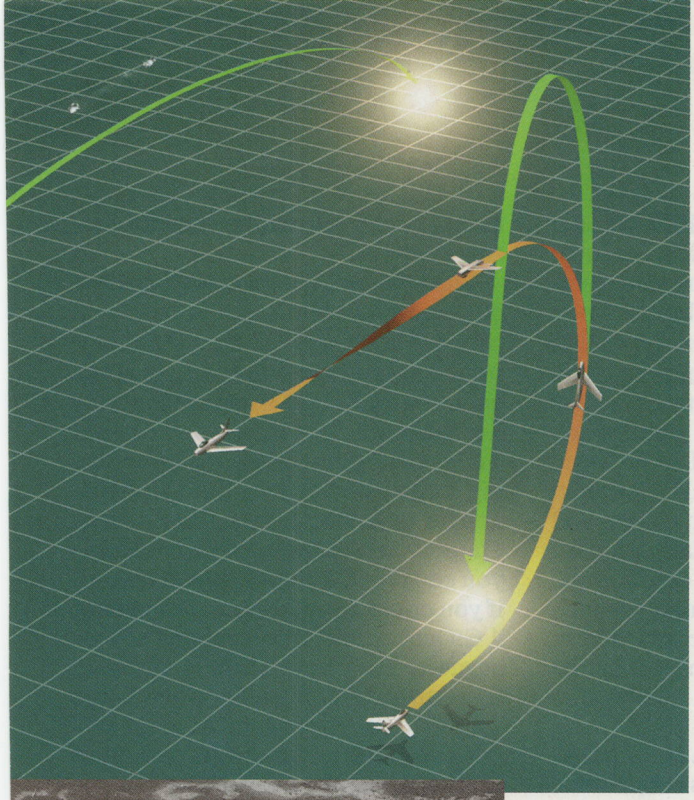
A basic toss maneuver (left) lobbed the weapon a considerable distance from the release point, and therefore the pilot needed an offset visual reference from which to time the start of the climb and the release. The "over the shoulder" method (right) used the target itself as the visual reference, so the attacker could approach from any direction to avoid defenses. The Strategic Air Command chose the "over the shoulder" maneuver as its preferred means of delivering nuclear weapons.





The Low Altitude Bombing System, or LABS, indicator (highlighted) provided climb and heading cues...

TOP: JOHN MACNEILL; BOTTOM: ROBERT MIKESH (2)



...so that the Martin B-57 Canberra could loft its payload accurately. Pulling 3.5 Gs going up, the -57 could toss a bomb 9,000 feet high.

the B-47 through the half-loop and half-roll. But it seemed like an eternity. For those 40 seconds, I could see nothing but blue sky from the pilot's seat. After what seemed like hours, I was certainly relieved to see a horizon again. It proved for the first time that a medium bomber, the B-47, had the stability, power, and maneuverability necessary for the toss-bombing tactic."

Boeing assured SAC that the maneuver, properly flown within the 3-G structural limit, was safe. The next area of concern was the stress of low-level rough air hammering the B-47; its slim, flexible, 116-foot-span wings were considered especially vulnerable. Air Force test crews began flying low-level missions, but during the last phase of testing one of the bombers crashed soon after takeoff. No evidence linked low-level flying to the crash, and after a brief halt the tests continued.

The B-47s proceeded to subject the LABS system to weapons delivery testing, flying the toss maneuver first at minimum weight, then increasing the weight until the last run was at the airplane's maximum gross weight, 130,000 pounds. In June 1955, a B-47 tossed a 6,000-pound dummy nuclear weapon from a 2.6-G pull-up into a half Cuban Eight, and later tossed an 8,850-pound dummy bomb using the same maneuver. The maneuvers proved easy to perform, and the LABS functioned well. By December 1955, SAC was sufficiently satisfied with the tests to assign three B-47 wings to initiate a low-level-flying and LABS training program called Hairclipper.

The maneuver was "either a bomber pilot's dream or nightmare," recalls Sigmund "Alex" Alexander, former president of the B-47 Association, and the crews initially viewed the new tactic with some apprehension. Stewart Frasier, a B-47 bombardier/navigator stationed at Schilling Air Force Base in Kansas, remembers first hearing about it when he and his squadron returned from temporary duty in England. "They announced we had a new bombing plan," he recalls. "Then they showed us a short film of the B-47 LABS maneuver. We were surprised, to say the least, and there was a lot of concern among the crews. The wing commander heard about this concern, and a couple of days later he ordered all the air crews to assemble near the runway at high noon. He flew down the runway low and fast and then pulled up, over and down into a [half] Cuban Eight to demonstrate it could be done and the wings wouldn't break."

B-47 pilot Fred Lange flew a number of LABS training missions from MacDill Air Force Base in Florida. He recalls that the first LABS maneuver he flew with an instructor scared him "because the airspeed going over the top was very slow just before starting the half-roll. In the maneuver, the main thing I tried to do was to lock my knees and not work the rudder pedals to keep the aircraft lined up on a straight line and make a perfect maneuver. I was afraid that the rudder might fail—it was the weakest control surface on the B-47. [But] it just didn't matter whether we flew a perfect maneuver. I got used to it, and the real fun part of the missions was doing aileron rolls on the way to the bombing range."

In an actual operation, the B-47 approached the target at very low level while the navigator/bombardier located the target on his radar, computed the pull-up range, and put the solution into the pilot's LABS timer. At the point where the maneuver was computed to begin, a light on the pilot's LABS instrument came on and the pilot followed the needles into a 2.5-G pull-up. When the bomb released automatically, the pilot reduced back pressure on the control yoke to keep the B-47 right on the edge of a stall buffet as the bomber went over the top upside down at 85 knots, pulling a third of a G or less and flying on thrust alone. Once the aircraft had come out of the top of the maneuver and was diving, the pilot rolled upright as the copilot called off airspeed to make sure the aircraft did not exceed 400 knots in the dive—any faster and the B-47 suffered aileron reversal, a condition in which a deflection of the aileron tended to flex the wing in the opposite direction and roll the airplane the wrong way.

Overstressing the aircraft as it pulled out from the dive was a major concern—the B-47 had a structural limit of 3 Gs, and exceeding it risked catastrophic structural failure. B-47 pilot Robert Winn recalls, "There was nothing like flying along beside another B-47 and watching it start its LABS pull-up. The fuselage actually started to

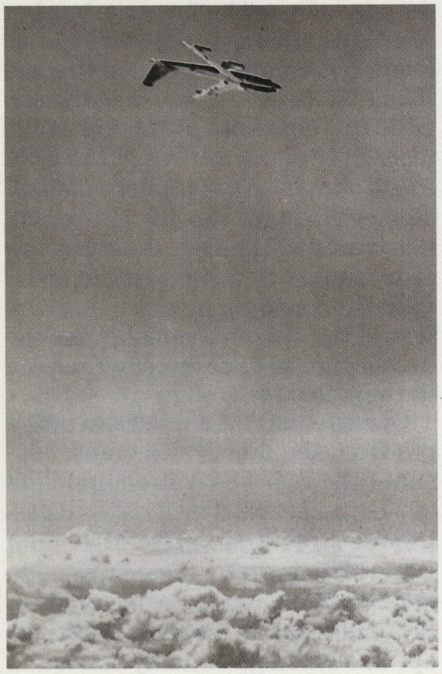
bend in a U-shape as the aircraft reluctantly entered the maneuver."

In practice, the missions presented new challenges. The navigator sat in the nose of the aircraft with virtually no outside view. Stewart Fraser notes: "Navigation for toss bombing in the B-47 was very difficult, especially at night. The aircraft bounced a lot at low level, and sometimes it was too rough for celestial navigation, too low to use the radar, and we were flying too fast for visual navigation. Often we just flew course, time, and distance.

"One night we got completely lost over Texas and did our pull-up over Dallas instead of the nearby range," he recalls. "Fortunately, we didn't hit anybody over Love Field, but at that point I decided my mother loved me more than the Air Force did, so I got out."

In the first year, accidents began to plague the Hairclipper program. One B-47 crashed on a bombing range in Florida, another failed to roll out of a LABS maneuver in time, and a third, with three instructors on board, crashed at night off the coast of California during a practice mission. Then, in early 1958, things began to come apart, literally, for the B-47 fleet. Six aircraft flying low-level missions were lost when wings came off. All B-47 low-level training, especially LABS, was suspended. Examinations revealed fatigue cracks in the "milk bottle" bolts (so named because of their shape) that joined the wing to the fuselage. The cracks were found on virtually all the B-47s that flew low level, and the culprit was suspected to be LABS. It was finally determined that LABS units had no more problems than any other, and the B-47 that Boeing regularly used for LABS tests had no fatigue cracks at all. At the time, however, structural analysis was very unsophisticated, and to this day unfounded rumors persist that the LABS maneuver was responsible for many of the crashes.

The Boeing B-47 Stratojet was the largest aircraft to fly the spectacular LABS maneuver.



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In the end, it became a moot point. While LABS training was suspended, new nuclear weapons were coming into the inventory that did not need to be tossed. And the new B-52s were better suited to low-level flying than the B-47s. These developments, combined with the accidents, led to LABS being dropped from the B-47 repertoire.

In mid-1957, while the B-47s were still fully involved with LABS, SAC turned all of its fighter-bombers and their nuclear mission over to the Tactical Air Command. TAC crews sat nuclear "Victor alert" around the world and continued training to use the over-the-shoulder maneuver, which the pilots dubbed "the idiot loop." The nuclear-capable F-84s were replaced by more advanced fighters, mainly the North American F-100s, which became the mainstays of the Air Force tactical nuclear attack fleet. By this time, the term "LABS" began to be applied loosely to virtually all low-level nuclear loft deliveries, not just those that used the mechanical LABS instruments.

While the F-100 performed considerably better than the F-84, the LABS on the aircraft was somewhat quirky. F-100 pilot Les Turner recalls how difficult it was to adjust: "The LABS gyro was in a place were it was impossible to see, so the pilot had to use a small mirror to set in the proper numbers for his mission," he says. "The best was a common dental mirror...and when a dentist or technician left the room with a pilot in the chair they had to take their mirrors with them or the mirrors would disappear. I still have my dental mirror and no, you cannot borrow it," he adds with a grin.

The system's location was not the only quirk. The F-100 introduced a link between the LABS and the fighter's autopilot to give an automatic pull-up, called "auto LABS," a feature that was not particularly popular. F-100 pilot Andy Stallings remembers, "I was having trouble performing the LABS maneuver well. Little things had a large effect on where the bomb would hit—you could pull too slow, or too fast, or, if you could, overshoot or undershoot 4 Gs and so on. Our weapons officer suggested I try 'auto LABS' to see what the maneuver looked like when it was properly performed. In 'auto LABS,' the autopilot had to be turned on at low level, and the F-100 autopilot was notoriously unreliable. The possibility of getting a nose-down command from a malfunctioning autopilot at 100 feet doing 500 knots made most pilots avoid engaging it, but I was young and indestructible. I tried it; it worked and worked well. But once I got the picture of what the delivery should look like, I didn't use the autopilot."

The 1950s also marked a period of competition between the U.S. Air Force and the Navy over the nuclear mission. The large Navy bombers—the Lockheed P2V Neptune, the North American AJ-1 Savage, and the Douglas A3D Skywarrior—were too big to do the LABS maneuver, but smaller Navy jet attack aircraft had the power to fly LABS maneuvers similar to the ones Air Force fighter-bombers used.

One early Navy nuclear delivery aircraft stood out in sharp contrast to the Air Force's aircraft: the propeller-driven Douglas AD Skyraider. At about the same time the Air Force began to develop a way for its fighters to deliver atomic weapons, the Navy began to plan nuclear deliveries using the Skyraider, mainly because of its extremely long range. The ADs' targets were as much as 2,000 miles away, and in the test program ADs flew as long as 13 and a half hours to see how the flights affected the pilots. As a result, the nuclear Skyraiders were modified with relief tubes and extra seat cushions, and the pilots carried a supply of aspirin for headaches caused by wearing their helmets for such a long time.

Pilots took their training for the nuclear missions seriously, and fliers assigned to the slow-flying "Able Dogs" called their training missions "Sandblowers" because the ADs flew so low that when they crossed the coast they kicked up sand. AD pilot Ralph Davis says, "The carrier flight deck was 85 feet high. We'd drop down after we took off and not climb back to that height again until we returned to land." W.R. Wilson, who flew ADs off carriers in the Pacific, recalls, "We practiced penetrating coastal defenses from 200 to 300 miles at sea on a routine basis. Some of the more spectacular missions were when we launched near typhoons in the belief that the trusty AD could penetrate such storms, attack the target area, escape the blast, and return to the ship. To everyone's amazement, we actually [flew through storms and returned] several times during training exercises in the 1950s."

In addition to the standard free-fall bombs, the ADs carried a weapon called the Bureau of Ordnance Aircraft Rocket (BOAR), which was a Mark 7 nuclear bomb with a rocket motor attached. It was made for the AD to loft with the LABS system, but it was not popular with the pilots. Skyraider pilot Tom Beard called the BOAR "a real killer. To deliver it, we would pull up to about a 45-degree climb until the rocket fired, then we would go into about a 135-degree roll and pull through to supposedly escape from the ensuing fireball. I always wondered if they figured that right. In the maneuver we were at about 1,400 feet inverted, and at night or in low visibility it was easy to split-S into the ground."

Air Force fighter pilots watching the slow ADs practicing their LABS deliveries were fascinated. "I was the range officer one day watching F-100s practice LABS, coming about 450 knots on the deck," F-100 pilot Mark Berent remembers. "Then this Navy AD Skyraider guy comes putt-putting along at—what, 150 knots? Then, over the bull's eye, he pulled up and in a flash was going straight up, putt-putt, release, roll and dive away—all in seconds, it seemed. But he seemed much closer to the bomb than the F-100s."

Dick Howard, a Navy AD pilot, learned first-hand that his aircraft would have had a hard time escaping from the blast of its nuclear bomb: "In 1959, my air group was allowed to do a training drop of a real, live, honest–to-goodness Mark 7 nuclear bomb that had exceeded its shelf life. The nuclear material was removed from the warhead, but everything else was operational, including the radar fuse, which was set for a 1,100-foot air burst. I was chosen for the mission. I took off, found the target, then pulled into the loft. The weapon released as planned. As I came over the top of the idiot loop, I looked back over my left shoulder to see what I could. The bomb detonated as promised at 1,100 feet, but it was not more than 1,100 feet from my aircraft! If it had been a nuclear explosion, I would have been in the fireball and wouldn't have had a chance."

For years, U.S. Air Force and Navy tactical crews practiced LABS maneuvers day and night, often in marginal weather, and people died in training. Most of the pilots felt that if they ever had to go to war and use the LABS, it would be on a one-way ride. Navy aviator Tom Beard summed it up this way: "We thought we were on suicide missions. Perhaps we all were—even the Air Force. Crazy days!"

The spectacular LABS toss and over-the-shoulder maneuvers were phased out as Soviet defenses improved. During the time it was employed, the LABS was used by a wide variety of Air Force and Navy fighter-bombers and by Germany-based British Canberra strike squadrons, which formed part of the British Nuclear Strike Force. But the LABS deliveries conducted by the B-47s are the ones best remembered. That great soaring half Cuban Eight was—and remains—the most spectacular maneuver ever performed by a large bomber.

This B-47 wearing heavy makeup was wrung out by Boeing pilots Jack Funk (left) and Dick Taylor.

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