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Loops, spins, and rolls

Training with Bill Kershner
in the Cessna Aerobat

BY WILLIAM K. KERSHNER

PHOTOGRAPHY BY MIKE FIZER

I first heard that Cessna was planning to market an aerobatic version of the 150 when I was contacted to work with people there in writing the *Cessna 150 Aerobat Training Manual*, which was to be used by the flight schools that were setting up an aerobatic program with the airplane. At the time (July 1969), I was teaching aerobatics in a Beech Musketeer Aerobatic Sport III. ■ I went to Wichita, Kansas, twice and had the pleasure of working with Bill Thompson, Joyce Case, Ed McKenzie, Jim Kemper, and Milt Adamson and his owners' handbook illustrators. Case and I flew a couple of times in an Aerobat, and I watched the movies of the airplane with Don Pittman flying the maneuvers. After seeing one of Pittman's ultra-short landings, my comment was that I could do the same thing in my Aerobatic Sport—and have it repaired and ready for flying again in less than three months. ■ In our meetings,



we all agreed that one maneuver that wouldn't be included in the training manual was the split-S (a half-roll and a half-loop pull-through) because of the danger of the pilot's exceeding the redline if he or she had not slowed the airplane enough during the half-roll. I had already had a student do this to me, resulting in a grounding of the Sport until a mechanic performed the equivalent of an annual inspection on it. However, the reverse Cuban 8, in which the airplane is slowed to 100 knots and the nose then pulled up to a 45-degree pitch before the half-roll and pull-through, is an approved maneuver in the Aerobat.

I conferred with the pilots and the illustrators, deciding that side and top views of the Aerobat in various banks and views from the rear could be superimposed on backgrounds of fields below,

and the horizon, to show the steps of a maneuver. I felt that each view from outside the airplane should be matched by a view from the cockpit as it would be seen by the pilot. I had used this technique before in a couple of my flight instruction manuals. The result was much better than I had anticipated because of the greater skill (than mine) of the illustrators at Cessna.

I worked for several weeks, arranging the order of introduction of the maneuvers and making rough sketches, then went back to Wichita in November 1969 to finalize the order of the chapters in the training manual. I had a most enjoyable working relationship with the people at Cessna. (Hey, these folks were *the enemy* when I was working at Piper Aircraft and we were competing for military contracts.)

My time with the Aerobat didn't end with writing the syllabus. At this writing, I have 400 hours instructing in a Cessna 150 Aerobat—and approximately 2,500 hours instructing in the 152 Aerobat—and so I have a few comments: The major setback is the rate of climb (or lack of it), particularly at high density altitudes. Of the two, the 152—with its 110 horsepower—has a noticeably greater rate of climb during hot summer days than the 150, which puts out only 100 hp. There has been an STC to put a 150-hp Lycoming (272 pounds) in the 150 Aerobat (Continental O-200, 210 pounds), but (forward) center of gravity limits required that the battery be taken out of the engine compartment and put in the tail area. The new mass distribution made for "interesting" spins; in one case, an airworthiness directive was issued that required



Bill Kershner illustrates to student Vickie Cogan how an aileron roll is executed (above). Structurally, the Aerobat is replete with extra doublers and rivets.

attitude over, say, the Pitts, Extra 300, and others because the Aerobat has a roll and pitch rate similar to those of the general aviation airplanes that the trainee is currently flying. Most have only flown side-by-side wheel-control airplanes (many have flown the standard 152 during their initial training), so there is no culture shock of stick control, tailwheel, and a roll rate that has the airplane 20 seconds ahead of the pilot. In other words, the newcomer makes a transition to aerobatics in a less-than-spectacular way, but I always encourage trainees to move on to higher-performance airplanes and more complex maneuvers at other aerobatic schools. Some "graduates" have bought Aerobats, flown them awhile, then bought a Pitts, Sukhoi, or Extra 300L and entered competition. Each graduate is given a cap and patch with the Ace Aerobatic School logo of an Aerobat inverted with the motto *Non Compos Mentis*; one definition is *mentally incompetent to stand trial*.

A disadvantage of the control wheel (versus a stick) is that it has to be turned 90 degrees to get the desired full aileron deflection. This is awkward when attempting to do a left roll using only the left hand. (The right hand is adding full power as the airplane becomes inverted.)

The little airplane is forgiving and inexpensive to operate and has comparatively few airworthiness directives. Some are of the recurring type, such as checking the seat tracks periodically for elongation of the lock-holes or the one-

time requirement to change the carburetor float (and some apply only to certain airframe or engine serial numbers).

Because the Aerobat doesn't have an inverted oil or fuel system, the maneuvers stay in the positive-G area with the normal range during my course of 0.5 to 3.5 positive Gs, with some possible ranges from zero to plus 4 Gs. Even at that, the engine may hesitate in some of the recoveries from inverted flight. Note to newcomers: One positive G is in effect in straight-and-level, upright flight, and it is what you are experiencing as you read this. If you are reading this while riding a roller coaster or hanging by your heels from the monkey bars, you are *not* experiencing one positive G—but that's not my problem.

When Cessna stopped manufacturing the Aerobat in 1984, I requested permission to obtain the *Aerobat Training Manual* material to expand the book for introductory aerobatics. This was readily given, and I was sent the material (negatives, drawings, etc.). I used these with the understanding that I would make it clear that the book was no longer a Cessna product (a reasonable request since the company would no longer have control of its contents). I then copyrighted it for publication with my other books at Iowa State University Press as *The Basic Aerobatic Manual*, which at this writing has sold more than 20,000 copies. A syllabus was included in the earlier training manual but the updated version was expanded, based on further experience with instructing in the airplane. I also upped some of the maneuver entry speeds slightly as I gained more experience in the airplane and with training techniques.

I wanted to set up my own syllabus so that the trainee would get an introduction to aerobatics without significant negative Gs.

I chose the Aerobat for the type of introductory training that the nonaerobatic pilot wants for a couple of reasons cited earlier, plus the fact that the airport I fly out of has strong crosswinds on occasion, and the nosewheel is welcome when the crosswinds are strong and gusty. I don't recall canceling flights because of crosswinds, but I'm sure I must have done so on various occasions in the past 35 years here at Sewanee, Tennessee. Having flown 31 types and models of tailwheel airplanes and instructed in 18 of them, I'm sure that there would be days here when I would be hesitant to launch (or recover) in certain tailwheel trainers.

Some aerobatic instructors tend to

new placards to be placed in view of the pilot, indicating that with this modification spins are prohibited and the airplane is to be operated in the Utility category, with only steep turns, chandelles, lazy 8s, and stalls (except whipstalls) with slow deceleration allowed.

The basic empty weight of the Aerobat is approximately 16 pounds heavier than the standard Cessna 150/152 because of the added structure necessary to put it in the Aerobatic category. When I observed the first ones being made in Wichita, I was impressed at the number of doublers, extra rivets, and other structural additions to the airplane. (The wing struts are larger and the skin is thicker in many areas.)

My aerobatic course is primarily for safety, or defensive flying; I prefer to use the Aerobat to introduce pilots to aerobatics and recoveries from unusual

sneer at the Aerobat because it is not a "real" aerobatic airplane. I can say from personal experience that the Grumman F8F-1 Bearcat would certainly outclimb it, but for my purposes it fits my requirements. I can do four- and eight-point rolls, square and eight-sided loops, and other more advanced maneuvers. (Don't ask how much altitude is used in the dive to get the entry speeds for some of them.)

I bought my Aerobat in 1984 for just under \$14,000 when it had 1,056 hours' total time on airframe and engine, and it's paid for itself several times over. You might expect to get a used Aerobat (there are no new ones) in a range from \$20,000 (high-time airframe and engine) to maybe \$40,000-plus for a cream puff with low time.

The attitude indicator in my airplane is still in operation at 3,800 hours, although it's getting slow to re-erect. The heading indicator was overhauled at about 3,100 hours' total time. There have been two vacuum-pump replacements since 1984.

The original Lycoming O-235-L2C engine was traded at 2,000 hours for a factory-remanufactured engine with a 2,400-hour TBO, which now has fewer than 1,800 hours on it.

The alternator control unit (voltage regulator) was replaced twice and the alternator once. The shimmy damper has required periodic servicing (a Cessna 150/152 problem) but has not been a major factor. There has been an AD for periodic inspection of the McCauley prop hub; no problems were found. The exhaust stack was replaced once during my 15 years of ownership.

In summary, the airplane will, if nothing else, teach a pilot the basics of aerobatics and give him or her an appreciation for energy conservation, and maybe give a boost to go on to more complex, high-performance aerobatic airplanes.

It is my ambition to compete with my Aerobat in Unlimited competition at Fond Du Lac, Wisconsin, and win over the Extras, Sukhois, Pitts, and other exotic competitors. After all, I have 110 horsepower and an NACA 2412 airfoil to work with. □



The wing struts are larger on the Aerobat, and the four-point harnesses are appreciated during aerobatic maneuvers. Jettisonable doors and two slip indicators, one on either side of the panel, are also unique features of the aircraft.



i Links to additional information on aerobatic flight can be found on AOPA Online (www.aopa.org/pilot/links.shtml). William K. Kershner, AOPA 084901, a flight instructor and writer whose textbooks are published by Iowa State University Press, has been flying for more than 50 years, has taught 460 students aerobatics, and received the 1992 National Flight Instructor of the Year Award.

Aerobat(ic) training syllabus

The first unit—First aerobatic flight

Assuming that the trainee has not performed any aerobatics before, the first unit of ground school has an introduction to the forces and effects of aerobatics, with an overview of the course and the G forces that he or she could expect to encounter. A warning to *not* do rolls or loops in a standard Cessna 150 or 152 (or any other nonaerobatic airplane) is emphasized. I mention that I have approximately 12,000 rolls and loops (plus other maneuvers) in the Aerobat and, after being in Wichita to see the material added to the airplane's structure, I'm not about to do aerobatics in a standard 150 or 152. The redline for the Utility category 152 is 149 kt; for the Aerobat it is 172 kt—23 kt higher. One trainee, who had aspirations for the airlines, asked why he could not roll the Utility category 152 that he was flying. My answer was that it is illegal, and the airlines at that time had their pick of a few from several thousand applications; if he were caught, he wouldn't have a prayer of getting hired. Another reason was that if a maneuver went awry, a split-S and high air-speed could result. One of his rolls did so, and we pulled out at 165 kt—close to my redline but 16 kt over that of the regular 152.

The trainee is briefed on the maneuvers to be done during the first flight: takeoff and departure stalls, 720-degree power turns, chandelles, wingovers, and aileron rolls. He is admonished to let me know the first signs of NSMFA (not so much fun anymore) so that I can make the proper decisions (stop, go home, etc.).

A briefing on exiting the aircraft and use of the chute is given at the airplane. One trainee on his second or third flight was attempting to put the chute on upside down. As I helped him to put on the chute prop-

erly, I mentioned that if he bailed out wearing a chute *upside down*, it would cause him to naturally *go up* and never be seen again. I have trainees review the exit procedure if there has been a time gap in the training. Checklists are used for all flights.

The second unit

This lesson is an introduction to the loop. The aileron roll and other factors of the first flight are reviewed. The loop, loop plus roll, cloverleaf, Cuban 8, reverse Cuban 8, and Immelmann are discussed in that order, but in most cases the airborne portion will end after a couple of two-parts-of-a-cloverleaf. (The full cloverleaf consists of four loops, each with a quarter-roll when the airplane is pointed straight down so that the four loops, if put 90 degrees to each other, would form a four-leaf clover when viewed obliquely.) The ground instruction is a brief introduction to spin theory, entry, and recovery procedures, so that incipient and developed spins can be practiced at the end of the flight. With approximately 800 spins in the C-150 and nearly 5,500 in the C-152, I found that the recovery steps cited in the information manual work exactly as described with no problems, whether the spin is entered from the top of a loop (too much back pressure) or from the "delayed" recovery of a snap roll. This has been proven to me with spins up to 25 turns—the recovery is the same as it is at three turns.

The third unit

The third unit consists of any aerobatic maneuvers that need to be reviewed (ground and flight) and the introduction in flight of the Cuban 8, reverse Cuban 8, Immelmann, and the repeat of spins at the end of the flight.

The fourth unit

This unit consists of a discussion of wake turbulence—its cause and effects—with briefing on recovery procedures. The half-slow-roll (crossed-control initially) recovery is not taught. Instead, the aileron-and-rudder-together method of rolling is taught, as would likely be used by a pilot in an inverted position to get back upright—and damn the resulting heading. (Few would have the presence of mind to cross-control under the stress of a real upset unless they were experienced acro pilots.) I've hinted that perhaps in a real situation it wouldn't be a bad idea during the recovery to head for the tower and let the folks in there get involved. (Just kidding.)

At 4,000 feet agl or higher, I roll the airplane inverted, noting the altitude in that position, and neutralize the ailerons. The trainee takes over and rolls the airplane upright while adding full power. I then check the altitude lost (from a minimum of 150 feet to 600 feet in some cases). "Push and roll, then pull as the airplane becomes upright!" is the anthem, but I always remind trainees that an aerobatic course or lots of practice still might not prevent an accident caused by wake turbulence, and to avoid it if at all possible.

The last item during this unit is a spin recovery by reference to instruments (not hooded) after having discussed it in the pre-flight briefing.

The fifth unit

The fifth flight is a roundup and review, a few additional new maneuvers such as the barrel roll and four-point roll, and more spins.

This is the usual syllabus for the course with an hour of flight allowed for each unit, but some may want the course broken down into shorter periods with more flights. Some are ready for loops after the aileron rolls on the first flight, and they move on quickly to four- and eight-point rolls in the later units. Others soldier on, still working at aileron rolls and loops and the contents of the first three units at the end of five hours. As I tell each trainee, "I hope you don't need this [recoveries from inadvertent inverted flight] but if you do, remember to push and roll, and then pull as the half-roll is completed." —WKK

