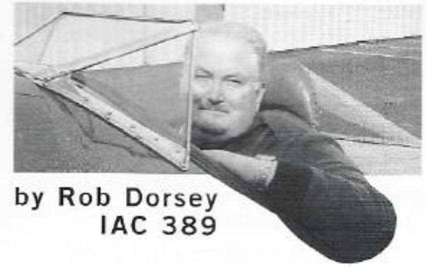


by Rob Dorsey
IAC 389

Lomcevak! The Secrets Revealed (Part 1)

Don't try this at home!

In the air, you'd better have your total wits about you if you try this stunt. Yes, I said stunt. Here's why.

There has probably never been a maneuver since the "tail spin" of early flight that has had so much lore and myth applied to it as the lomcevak. Fact is, no one had ever even thought of such a thing until the summer of 1958. In those wonderful and simple days, unencumbered by the rules of CIVA and IAC, aerobatics were judged on the merits of grace, rhythm, and showmanship, sort of like a multitude of 4-Minute Freestyles linked together. The grading criteria were scope, originality, accuracy, and presentation, with each carrying an equal 25 percent of the score. Every summer, over the green fields of the English Midlands, a superb contest was held that drew the best of Europe to compete in a three-day fracas of howling engines, graceful figures, and uninhibited flying. It was dubbed the Lockheed Trophy, and it was the mecca for all who loved aerobatics. It was also the de facto World Aerobatic Championship. Win it, and you were the best in the world, at least to the Europeans.

In that year, the friendly rivalry between the British, French, German, Swiss, and Czech pilots was at its height. The Czechs had recently taken their lovely Zlin 126, a friendly and docile trainer with a 100-hp Hirth four-banger, and

Lom•ce•vak
[lom•tzo•vák]
n.
Moravian dialect, Czech slang for a Chaplin-esque drunken stagger or a stumbling gait induced by strong drink. Example: "I've had too much Slivovitz can't walk without Lomcevak."

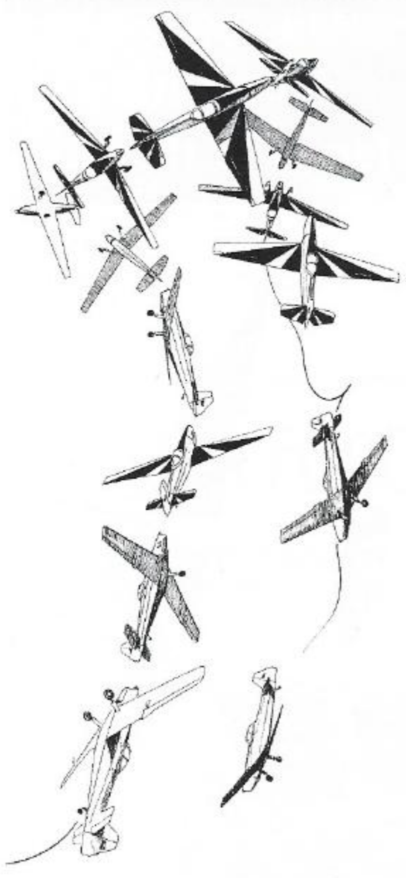
beefed it up by installing the 160-hp Walter Minor six-cylinder engine. This change, christened the Zlin 226, produced what may well be one of the best, classic aerobatic airplanes of all time, if not the best. With its long wings and clean profile, the 226 opened up the world of vertical flight as never before, and the pilots of other nations in their Stampes, Bückers, and Super Tigers (Yes, Super Tiger as in Tigermoth. There's a whole other story there.) could only look on in envious amazement as the Zlins vaulted across the sky. However, such greats as Leon Biancotto, Francois d'Huc Dressler and Le Chevalier, and Jean-Marie-Francois de Thonel d'Orgeix (pronounced d'Orgeez) still dominated through the mid '50s in their trusty Stampes and were loath to give up their turf easily.

Well, young Ladislav Bezák of Czechoslovakia had a penchant for innovation of the spectacular kind and an eye on the Lockheed prize. He had been hard at work in the new 226 developing some original figures to wow the judges. One was the flat spin that had heretofore only been encountered inadvertently, but when Bezák worked out the control inputs in the Zlin, it was a sight to behold. The other was the lomcevak, which, after much experimentation, took on several forms. Bezák could do tumbles end over end, wonderful swirling pirouettes where the airplane seemed to hang from its nose and spin about on the propeller, and a neat little trick where the airplane flipped over on its side and rotated on the wingtip. And each was, in the Zlin, a graceful and ballet-like maneuver that left every jaw agape, from the Moravian farmers to the seasoned (and often jaded) aerobatic judges. In 1958, just a few years after Ranald Porteous had demonstrated the first avalanche or snap roll on top of a loop, tumbling an airplane end over end was a considerable innovation indeed. While Bezák did not win that year, even with the lomcevak, it was the talk of the meet. If Ladi had done something like that just a couple of hundred years previously, they probably would have burned him at the stake. There were even some professional aerobatic pilots in the United States who simply said that they did not believe it and that it could not be done.

The lomcevak looks wild and dangerous. The fact is, in the proper airplane, it's not. It is the ultimate aerial stunt and holds all of the elements of the trickster's art, for although it looks like it should tear the airplane and its occupant apart with a swirling maelstrom of forces, the Czechs knew that it was just the opposite. To the pilot, the lomcevak was a gentle and low-stress ride, if you got it right. The reason is that there has never been a more aircraft-specific maneuver. An airplane will either tumble easily, with little stress, or it will not. We'll talk a little bit about the reasons, but the primary thing that you, as a pilot and aircraft owner, must get a grip on is that no matter how much you want it to be, your airplane may not tumble well or at all. If you try to force it, it is precisely like trying to teach a pig to tap dance. It will only succeed in frustrating you and annoying the pig.

From an engineering point of view, the lomcevak is dirt simple. Having an established outcome, (that is, the airplane tumbling ass over teakettles) and backtracking from that final result, you can ask yourself, "How would I get an airplane to tumble end over end?" Well, obviously, since the airplane is designed to fly through the air with some directional stability, we would need to reduce that stability to a point that would allow for the lomcevak's gyrations. That would assume that the actual tumble would probably need to take place at a very slow airspeed so that the stabilizing surfaces of the wing and empennage have a minimum effect. Also, we would need to produce the force necessary to make it tumble, and here's where we start to get into the airplane-specific part of the puzzle.

Building up nose-down pitching forces of such high magnitude takes far more than just pushing the stick forward and hanging on.



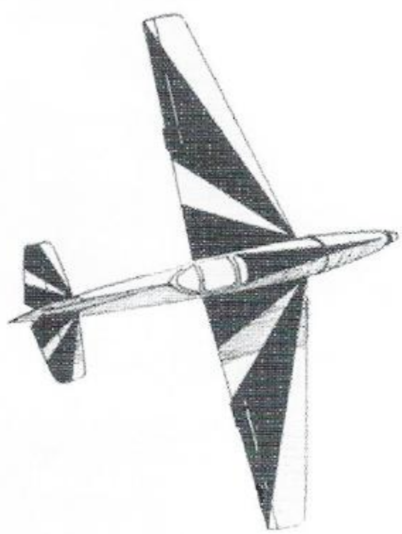
By way of example, let's take what are possibly the two most different aerobatic airplanes in the world, the Zlin 226 through 526 and the Pitts S-1. The Pitts is a very compact airplane, meaning that its mass is concentrated in the center of a very short airframe with short wings. The Zlins, on the other hand, have most of their mass located relatively far away from the center of the airframe. The Zlin has a long fuselage with a fairly heavy engine on one end and an equally heavy empennage on the other. Also, the wings of the Zlin are very long for an aerobatic airplane, even a monoplane. This, then, also tends to move the mass of the airframe out away from the center of rotation.

If you've seen a few lomcevaks performed, you've probably noticed that the tumble was orientated in a nose-down pitching mode. This means that during the tumble portion of the maneuver, the nose is pitching down, away from the pilot's head. Building up nose-down pitching forces of such high magnitude takes far more than just pushing the stick forward and hanging on. The previously stated requirement of doing the actual tumble at a very low airspeed would mean that the elevator would have little or no effect. No, we have to come up with some other way of charging the airframe with negative pitching energy, and this is where the lore of the outside snap entry was born.

When Duane Cole, Lindsey Parsons, and Rob Jocelyn returned from the 1962 World Aerobatic Championship in Budapest, they brought wild tales of this horrific, flailing, tumbling maneuver being performed by the Czechs, Hungarians, and others in their Zlins. Language barriers being what they are, the boys had watched intently, asked a few circumspect questions, and then came away with the erroneous notion that the entry for the lomcevak was nothing more than an outside, or negative, snap roll performed on an ascending line and allowed to go to term. This was, after all, the height of the Cold War, and while there is a certain brotherhood of airmen, the Eastern Europeans with the secret probably had little direct incentive to instruct the upstart Americans in the fine points of their now trademark maneuver.

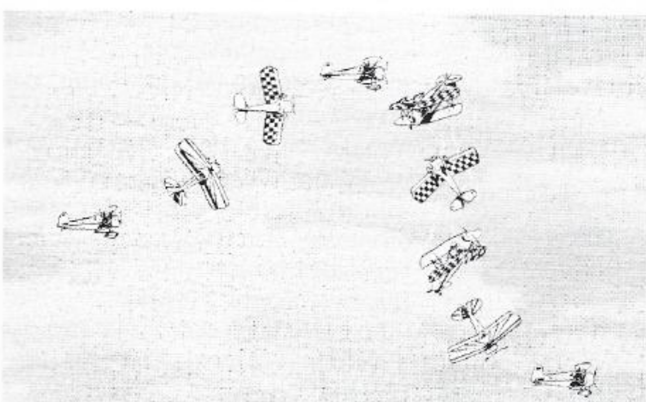
So, it had looked to our guys, absent any actual training in the figure, that you just pointed the airplane up about 45 degrees, slammed in an outside snap toward the rotation of the propeller, and hung on. This, then, they did. What resulted were some spectacular failures, figuratively and structurally. True, they finally got their biplanes to sort of tumble, but it was often at the expense of substantial negative G and the occasional propeller. "The devil," it is well said, "is in the details." And, our intrepid team had missed the big riddle of the lomcevak. They did not understand, or had not had it explained to them, that this was all about the new and experimental idea of "gyroscopics."

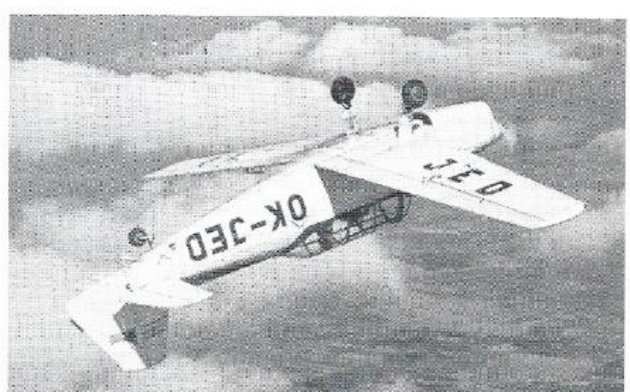
Once set in motion, the airframe components themselves could be considered to be a set of gyroscopes, each with its own rotational axis and each contributing forces to the mix.



What Ladi Bezák had discovered was that the propeller was not the only rotating part of the airplane that could be called a gyroscope. Once set in motion, the airframe components themselves could be considered to be a set of gyroscopes, each with its own rotational axis and each contributing forces to the mix. What Ladi had found was that, just as his experimentation with the flat spin relied on the gyroscopic effect of the fuselage in rotation to bring the nose up toward level, this "pitching moment" could be used to inject pitching moments into other maneuvers.

It works like this. Take your model airplane and hold it in an inverted spinning attitude, slightly on its back but mostly nose down. Now rotate it about a vertical line through the point where the wings meet the fuselage, the approximate center of gravity (CG). Notice that, as it rotates, the engine and tail section are on the extreme outside of the circle. By applying a little imagination, you can see that centrifugal force would try to force the engine out away from the center of rotation and to force the tail the same way. So, do this with the model, and you will see that it "flattens" the spin, "raising" the nose and "lowering" the tail toward a flat inverted attitude. This then is the "negative pitching moment" in its simplest form, and any time you perform an inverted or negative autorotation, that is, spin, there is an element of this negative pitching moment; yes, even in an inverted spin in your Decathlon.





> **Since it is the rate of rotation that makes the fuselage gyroscope tick, increasing that rate will only make the fuselage's effects increase.**

Now, let's add two more pieces of the negative pitching puzzle. If we are inverted, spinning with the rotation of the engine (that's an inverted, right rudder spin), and we increase the rpm and thrust of the propeller, there will be two effects. First, the gyroscopic procession of the rotating mass of the prop will tend to contribute to the negative pitching moment. Second, the prop blast will lend additional power to the fully deflected, trailing edge down elevator, which also contributes to the negative pitching moments, and, voilá! We will have, in those airplanes that are capable, a full blown, flat as a pancake, inverted flat spin.

Also, in your spin training (and if you have not had spin training, what are you doing even thinking about aerobatics?), you saw the inverted flat spin and probably noticed, particularly in the Pitts, that you were told to use opposite aileron to the rotation. Inverted that means right aileron with right rudder. You may have heard that, in the mixed bag of airframe gyroscopes at play here, the wings have been described as "anti-spin." That is simplistic at best, but true enough to be at least useful. Actually, the wings do "fight" the effect of the fuselage, but they carry a tool that can greatly help the fuselage do its gyroscopic work, and that is the ailerons. Since it is the rate of rotation that makes the fuselage gyroscope tick, increasing that rate will only make the fuselage's effects increase. By introducing aileron against the spin, right aileron with right rudder inverted, we accomplish two things. We provide some drag on the "inside" wing in the form of adverse yaw, and we use any available aileron rolling power to keep the wings from "flying" into the spin rotation. These effects then tend to increase the yaw rate, what a spin is all about, and flatten the attitude, which is what a flat spin is all about.

Next month we will dig into just what a flat spin has got to do with the lomcevak anyway.

The answer is: Everything!