

SUMMER/JUNE 2021

SKY LINES

FLYING WITH DISCIPLINE, SAFETY IS AN ATTITUDE

Calling it a day, eh?

After 20 years, Canada's beloved
CHAT bids a fond farewell.

California Dreaming.

And Flying. The Thermal Clinic Recap

Gainesville Clinic Recap:

Florida Formation Flying Returns

North American Aviation History:

The Ultra Sabre

NORTH AMERICAN TRAINER ASSOCIATION

PROFILE OF AN AIRSHOW WITH THE **NORTH AMERICAN T-6**

Excerpted from 36,000 hours in the sky: The story of Walter Eichhorn and Toni Eichhorn

BY MICHAEL LINDE



Toni Eichhorn, lead, Walter Eichhorn, wing. Photo | Sven Vollert

When the Eichhorns whirl their planes through the air, everything looks so simple and almost weightless. But the insider naturally knows that behind this show there is a lot of thought, work and training.

First and foremost, the limits of the aircraft have to be considered. And then there are the limits of human performance, in short, an aerobatic aircraft normally endures more than a human being who, at certain acceleration values, first suffers visual impairment, so-called gray-out, and at high G-values even becomes incapable of action; G-values at which the aircraft can still continue to fly unaffected.

5-6 Gs are feasible for the trained pilot - whereby it depends very much on the length of the effect of this acceleration, the fraction of a second only, or several second. Modern aerobatic planes can



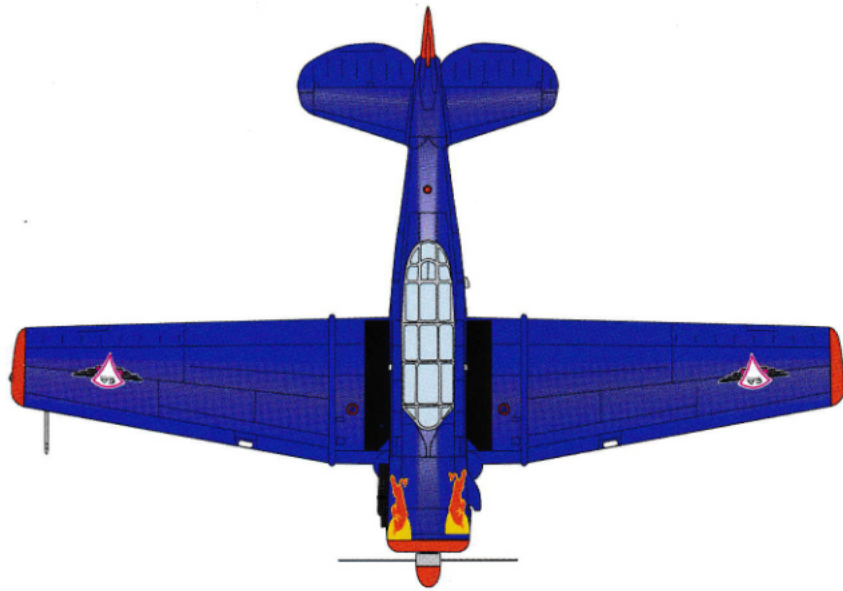
2AT - 6 Pin

be flown up to 10 Gs both positive and negative, even under this load they still have a safety margin.

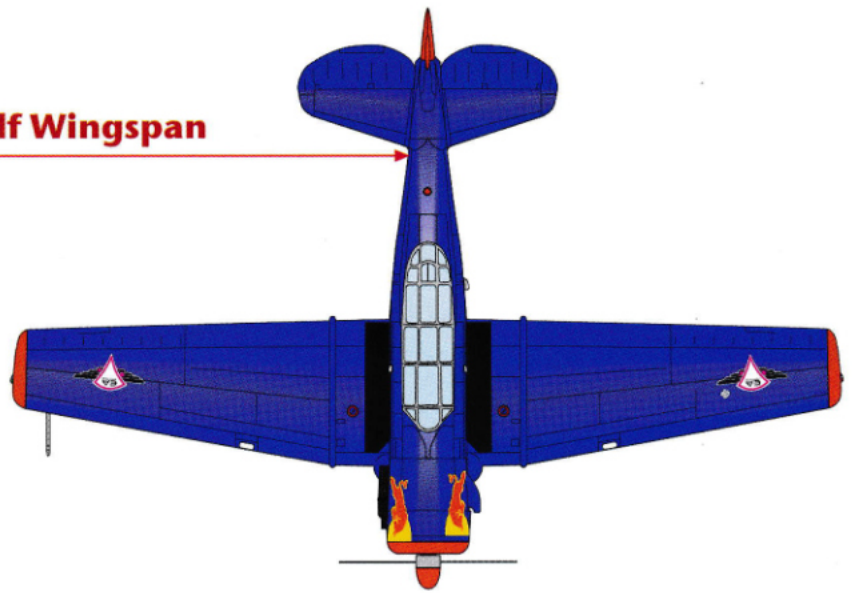
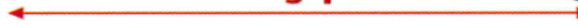
The third limiting factor are the official regulations. In order to guarantee the safety of spectators - and pilots as well - the responsible aviation authorities issue exact regulations for each flight demonstration, which must be strictly observed. These are regulations

concerning the minimum safety altitude, the distance to the spectators, but also noise protection regulations such as lunch breaks in the neighborhood.

Another factor is the weather. Of course, an air show can only be held under visual flight conditions. Beautiful weather should already be at an airshow. Important is the cloud base, the aircraft must not disappear on top in the clouds. For this point, Walter has developed two different flight programs, one which can be flown with a cloud lower limit above ground of min. 2,000 ft (approx. 600 meters), the vertical or even normal program, and a horizontal program if the cloud base is only 1,000 ft (300 meters). Other factors are visibility, where three kilometers (2 miles) is the minimum. Another important factor is the current air temperature. It influences the performance of the engine and the lift of the aircraft in a not negligible way! Thus, at 30 degrees Celsius, approx. 10 knots



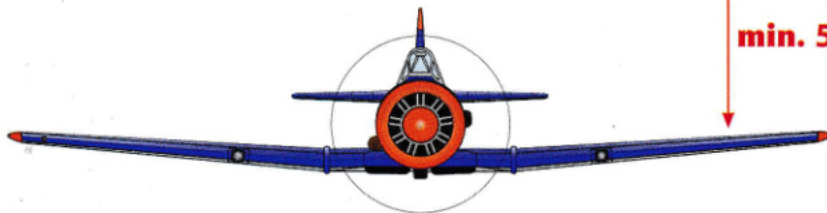
Min. half Wingspan



A major disadvantage of the T-6 for true competition aerobatics is its Pratt & Whitney R-1340-AN-1 Wasp carburetor engine, which does not allow negative flight figures. These are flight conditions in which the gravity acting on the aircraft assumes zero or even negative G values. The outside loop would be such a negative flight figure. As soon as the pilot pushes the stick forward and the G-value drops below zero, the flow of gasoline in the carburetor stops and the engine stutters and loses power drastically. An engine with a diaphragm carburetor or fuel injection does not have this problem, but the Pratt & Whitney R-1340-AN-1 Wasp is not equipped with it. Nevertheless - Walter and Toni Eichhorn have proven it for over 20 years - you can fly a very attractive program even without negative Gs. The trick is to keep the zero and minus G states very short. Another important factor is the power-to-weight



min. 5 Meter



must be added to all speeds mentioned later and all vertical figures must be set approx. 500 ft (150 meters) higher. The North American T-6 used by the Eichhorns over 20 years was developed as a training aircraft for the training of US fighter pilots in the 1940s. Although it has aerobatic capabilities, it is not an aircraft designed explicitly for aerobatics (like the Eichhorn's aircraft of today, the Extra 330 LT). However, since fighter pilots must be able to control their aircraft safely in all conceivable flight situations, the training aircraft must also be able to reproduce the profile of the fighter aircraft. This is still the case today, as in the 1940s, when the T-6 was used as an Advanced Trainer (AT), as the last training model before the actual operational model, such as the P-51 Mustang or P-47 Thunderbolt.

ratio, i.e., how many kilograms of flight weight are needed for one hp or one kW engine power. The T-6 has 600 hp and weighs up to 2.5 metric tons. This results in a ratio of approximately 4 kilograms per hp. Today's Extra 330 has 315 hp, but weighs only about 800 kilos in aerobatics, which is 2.5 kilos per hp. Furthermore, today's aerobatic planes are much more aerodynamic than the T-6's. To make aerobatics look elegant and fluid, the T-6 jockey uses a trick: Instead of just using the sheer power of the engine, he also uses the energy of the

situation to fly his figures. Put simply, he has to create his figures in such a way that he is slow up and as fast as possible down again to get back up with the speed and mass of his plane. (The American aerobatic pilot R. A. "Bob" Hoover has driven this energy management to perfection. With a 2-engine business aircraft, the Shrike Commander, anything but an aerobatic plane, he developed an air show, the highlight and conclusion of which was that he turned off both engines in flight and flew a loop and a roll eight times in gliding flight before he landed without an engine and rolled exactly to the stands of the spectators. Alone with the kinetic energy of the plane, paired with altitude and speed. Bob Hoover also demonstrated this stunt - which is nothing other than the precise pushing of the physical limits of aerodynamics - once also in Germany in the 1980s, at the ILA in Hannover.)

Therefore, the beginning of each air show with the T-6 is a climb to the starting altitude of the program. This starting altitude is 1,500 feet (450 meters) above the altitude of the respective airfield. In a wide 270-degree curve, the two T-6s that

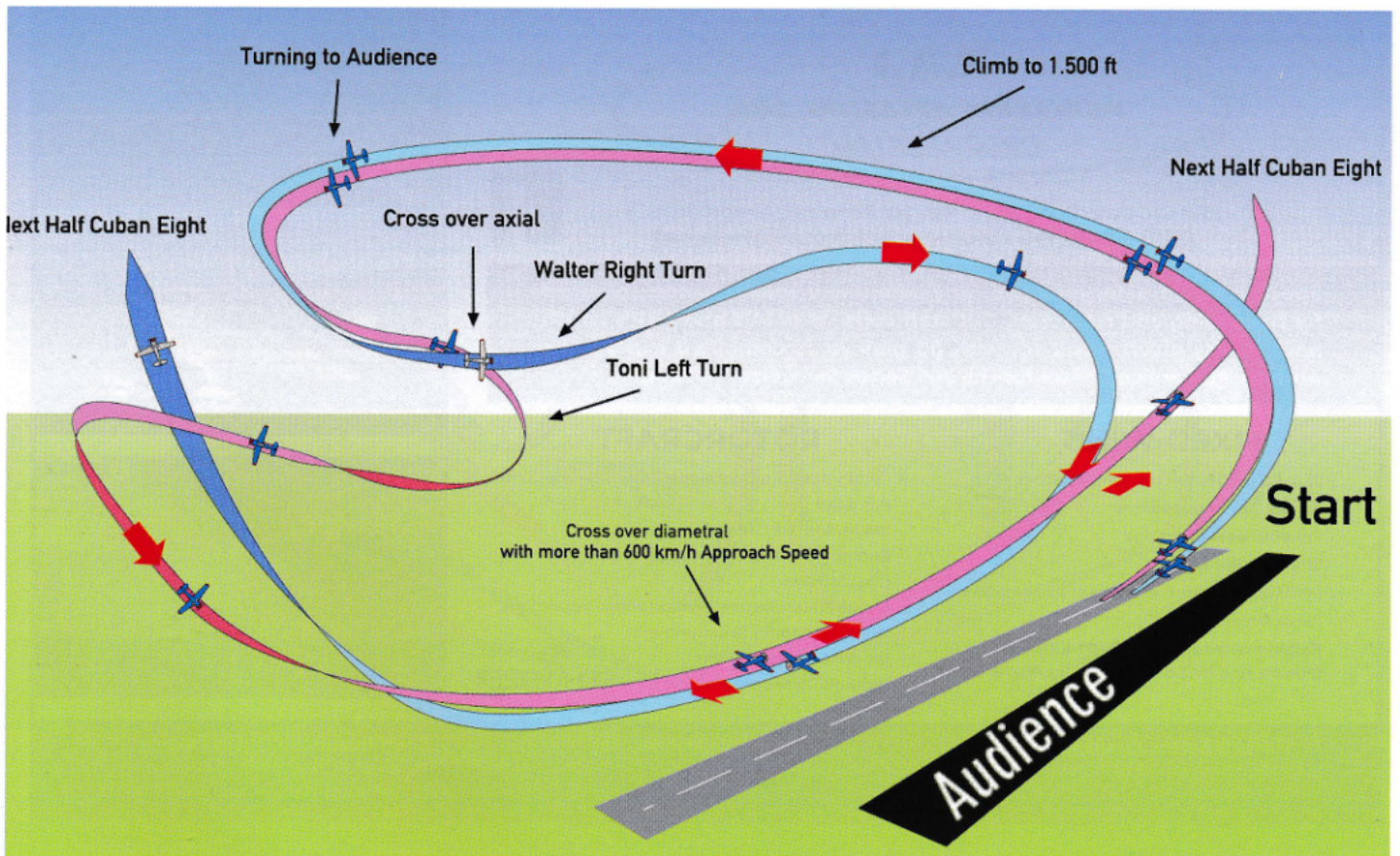


Nesterov Stamp

have just taken off fly directly towards the spectator stands. Long before they reach the spectators, they turn left and right in a spectacular 135-degree crossing curve. The photo on the left shows exactly this moment. Curve changes, sweeping curve, now the T-6s come from the left and right at high speed and fly past each other in front of the spectators at a five-meter distance at about 700 km/h. Pull up again in a 135-degree curve. Flying away from the spectators, they meet for formation flight and come back towards the spectators in a wide curve from a height of about 2,000 ft. From this height they are press against the ground and thus pick-up speed. The entry speed for the next figure,

a half "Cuban Eight" is 180 knots (330 km/h) at the beginning of the upswing at 500 feet. At the peak of the upswing, the speed is still about 80 knots. It is important that at this moment at least +1 G still acts on the vertical axis of the plane, even if it is lying on its back. In the downward third quarter of this arc, the two T-6s will turn back to their normal flight position and fly at high speed in exactly the direction from which they just came.

How does the "Cuban Eight" get its strange name? It was first unintentionally demonstrated in 1936 by the pilot Leonard James Povey when he failed an "Avalanche". When asked by the judges, he spontaneously named the figure "Cuban Eight". (Although Povey was an American, he lived in Cuba from 1934 to 1938 and, on Batista's behalf, built up the air force there). Next question: What is an "Avalanche"? The avalanche, French for "snowslide", is a combination of a half loop with a torn positive role in the upper peak. The loop itself must be round in all its parts and the torn roll must be exactly at the highest point.



For a whole "Cuban Eight" after the first half just described, the same maneuver is immediately performed again in mirror image. For the viewer the flight path looks like a vertically lying eight. In nosedive flight the T-6 accelerates to 180 knots, at the lower point of the interceptor arc approx. 3 - 4 G now act on the aircraft and pilot. With this ride it goes up again with about 45 degrees to the starting altitude of the next figure. Again, the two T-6s come in close formation from the left. In a steep orbital inclination flight from 3,000 ft they pick up speed again, and the classic aerobatic figure that every child knows, the "looping" follows.

A little story about this as well. The aviation physicians of the beginning of the 20th century did not consider a loop to be survivable for the pilot, the G-forces on the pilot's body and brain would be too great. Even the airplanes of that time were not trusted to perform this maneuver, at the latest when pulling into the horizontal plane they would disintegrate! A Russian military pilot, Pyotr Nikolayevich Nesterov, risked the "impossible" maneuver on August 27, 1913. We know this today

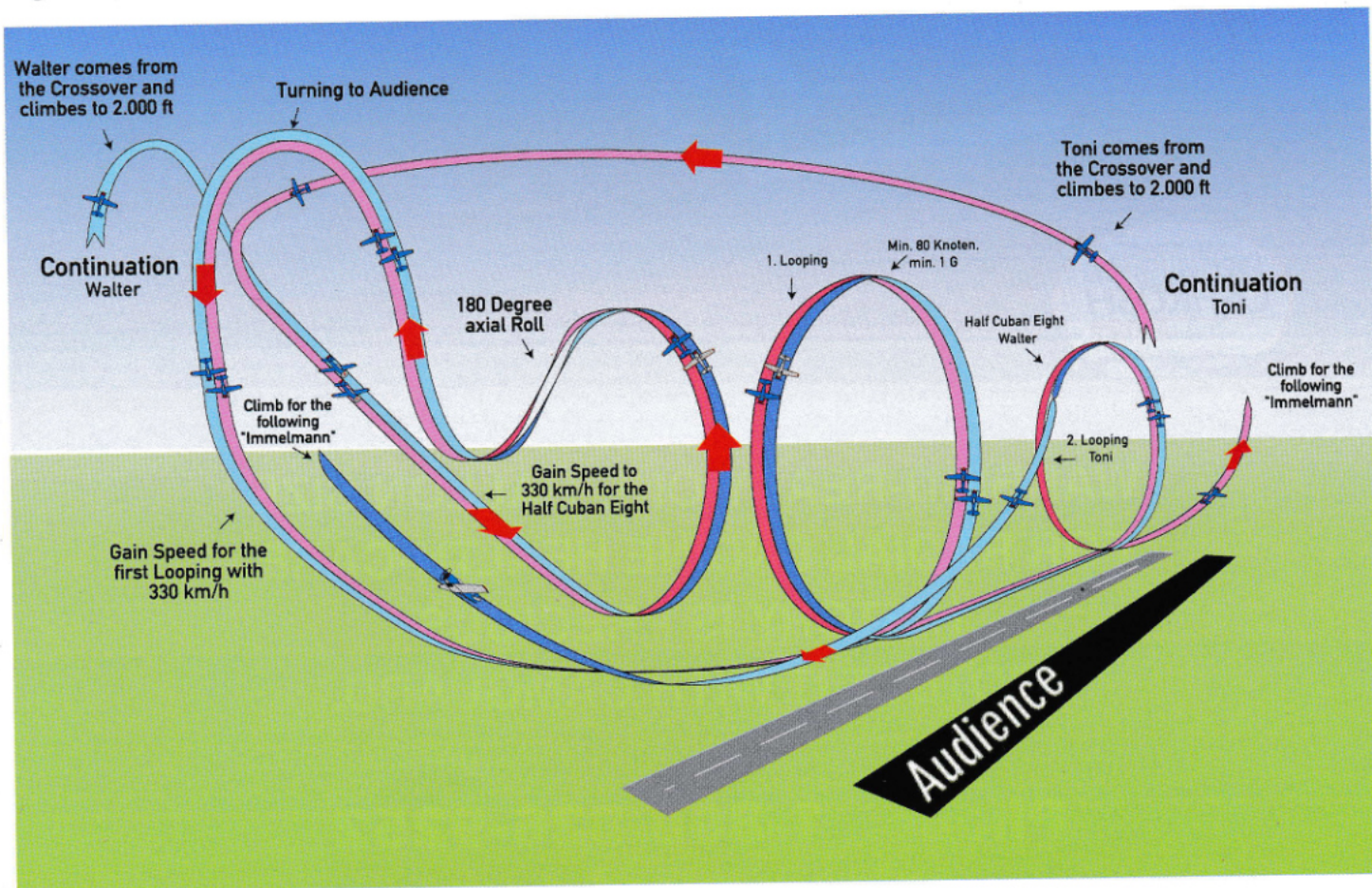


Crossing T-6's

because he was disciplined for this "indiscipline," the military record has been preserved. 50 years later, in 1963, the Soviet Union honored its daring pilot with a 10 kopecks postage stamp.

The figure belongs to the easier to fly aerobatic maneuvers. The goal of the competition pilot is to fly the circle

absolutely round. The looping begins in a fast horizontal flight (with the T-6 at about 300 km/h). In order to fly the figure in a plane, it is necessary to check that there is no banking position, e.g., by looking sideways to the wing tips before the horizon. By coordinated pulling of the elevator the vertical circle is executed. At the peak the elevator is released for a moment, otherwise the circle would resemble an egg in the upper part. The G-load remains positive during the whole flight maneuver, i.e., the pilot never hangs in the seatbelts. Then the elevator is tightened again to recover the plane. The difficulty of looping is to fly it really circular. In this case (as with all aerobatic figures) it depends on how it looks to a spectator on the ground. Since the aircraft flies slower in the upper part of the loop, the rate of turn must be lower there. Furthermore, the pilot has to compensate for any wind by adjusting the turn rate in the different phases of the figure and even by deliberately pushing the figure in crosswinds. Since the pilot has no direct clue what the figure looks like from the ground, it requires a lot of experience to be able to fly the looping really clean in all



situations, since any uncleanliness would be immediately visible. The looping is therefore one of the easiest, but also one of the most difficult aerobatic figures. For the Eichhorns, there is also the fact that "Wingman" Walter has to hold exactly his position during the loop to "Lead" Toni.

The fascination of formation aerobatics is the fact that during most of the performance the two planes involved seem to be a single plane, as if they were firmly connected. The wingman holds the position relative to his lead, no matter what crazy figures he is flying. In order to do this to the meter at 200 - 300 km/h, the wingman must of course know exactly what the lead will do next. Preparation, an exact program and a lot of training are the basis of every airshow. During the demonstration, constant radio contact with the tower is necessary. The lead announces every change of direction and performance to the wingman with head or hand movements or via radio: „Pull up ... Now!

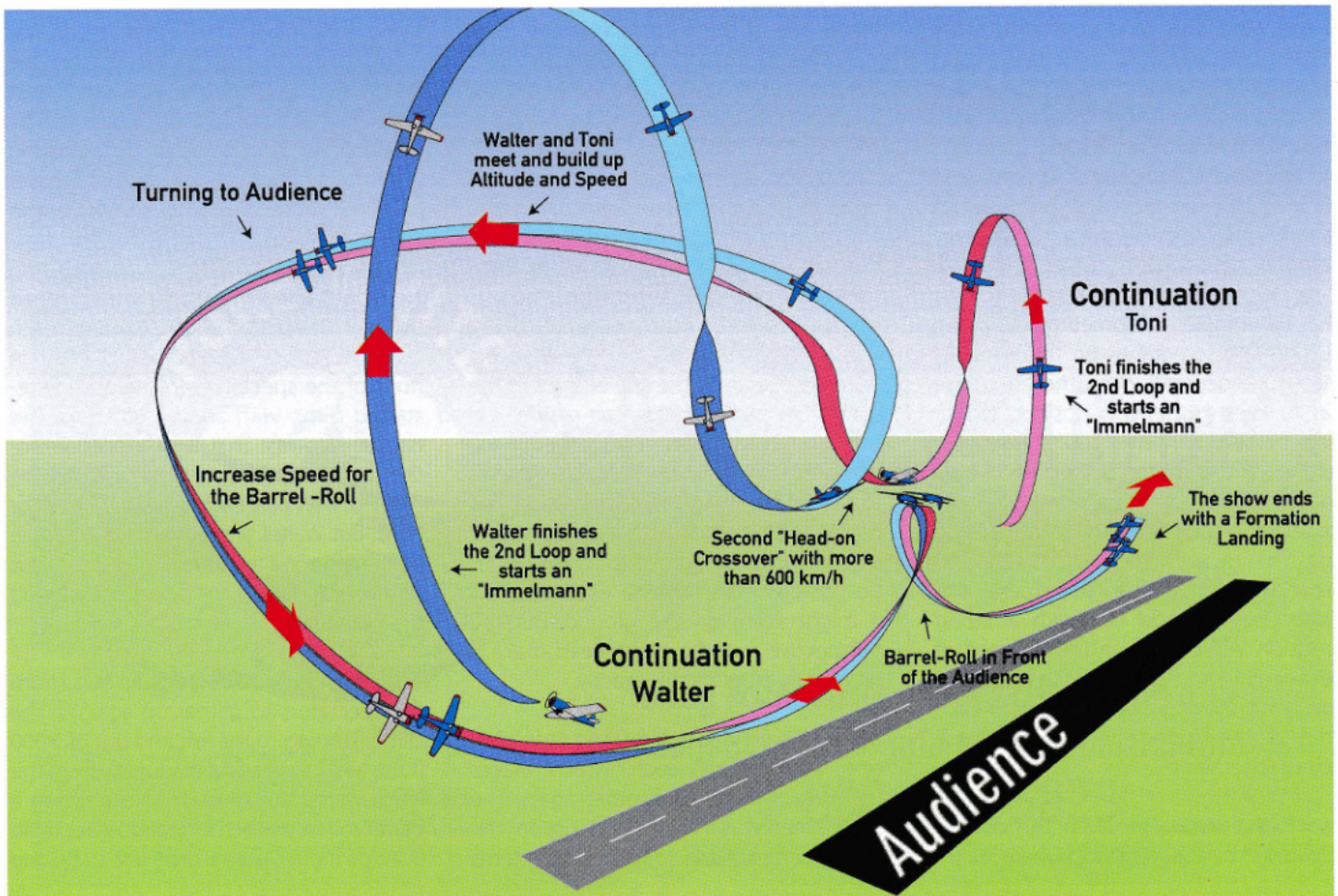


T-6 Loop

There is a strict work division during formation aerobatics. The lead flies the program that has been agreed upon beforehand. He is responsible for adhering to the operating limits of the aircraft (speeds and G-loads), and for complying with official requirements (minimum flight altitude, distance to

spectators). He is also responsible for the airspace observation, because if the demonstration takes place outside of a controlled airspace, i.e., on small airfields, it is not completely impossible that another aircraft might inadvertently get in the way of the aerobatic pilot. The lead gives the commands that initiate the individual figures. He also has to make sure that his wingman comes along, i.e., that he is able to follow his flying figures at all. Anyone who has ever participated in a marching formation, be it a military or carnival parade, a panning shot of several people marching in a row next to each other, will remember that the people running on the outside can really work up a sweat to keep their correct position. While the ones on the inside have to take very small steps to keep the ones on the outside from getting lost.

One difficulty that should not be underestimated is the wind. Really windless days are rare in our latitudes. Everything that moves through the air, from the tiniest insect to the heaviest





Walter on his last transfer flight to Salzburg-Austria with the T-6 D-FHGR, which he owned for 44 years. In the background the skyline of Frankfurt-Germany.
Photo | Michael Linke.

Airbus A380, is exposed to the influence of the wind. The wind constantly shifts the aerobatic pilots above ground during their show. Exactly in the direction and at the speed with which it blows. The lead must constantly observe and counteract this so that the figures look as they were planned and so that the show does not at some point blow in the wind far away from the spectators!

The wing-man is sometimes on the outside and sometimes on the inside of the figure, depending on the figure. He has to keep his relative position to the lead by very sensitive and anticipatory setting of the motor power. His whole concentration is on this one task! He looks for reference points on the lead machine and tries to keep the exact angle and distance to them. The real experts, like Walter Eichhorn, do this with amazing precision. Although at a flying speed of between 250 and 350 km/h the planes are constantly moving a little relative to each other, on the ground it looks as if they are bolted together!

Back to the airshow program: The looping is followed by a second loop where Walter

and Toni separate during the downturn. While one of them completes the loop, the other one turns 180 degrees around the longitudinal axis, turns the loop back into a half Cuban Eight and flies away in the opposite direction. In a "split," the two planes separate/cross each other in order to fly on different flight paths to a common meeting point again. This should succeed although the pilots do not see each other for several seconds. Radio is also used here as a means of coordination. This way breathtaking flight maneuvers succeed directly in the line of sight of the spectators. What looks "hair-raising" on the ground for the inexperienced pilot, however, is always in the "safe zone" thanks to a lot of training and coordination. The decades of airshow practice of Walter and Toni Eichhorn prove it. The airplanes do not come so close to each other as it might seem on the ground. But the perspective and the high speed make it difficult to estimate this exactly.

Both pick up speed again, flying separately one "Immelmann" each, which makes them fly towards each other again. The "Immelmann" is half a loop up, in the third quarter of the loop the pilot turns

his plane back to normal and continues flying horizontally. The German World War I fighter ace Max Immelmann was the first to fly this maneuver. It is the fastest possible maneuver to change direction by 180 degrees, e.g. to follow an oncoming enemy aircraft. It is a standard maneuver for every fighter pilot in air combat to this day!

Now both fly again with maximum speed in orbit inclination flight towards each other, to cross each other directly in front of the spectators in the already restarted climb with about 700 km/h. This happens so fast that it is impossible for the spectators to determine whether the two T-6s flew past each other on the left or right. But Walter and Toni made a simple agreement. Walter always flies past Toni on the side facing the spectators during this maneuver!

There is another 90 degree turn away from the spectators to gather up again in the climb. Turning to the left and out of 2.000 ft the two come again diagonally from the left towards the spectators to perform a barrel roll in perfect formation directly in front of them. After a large left circle, the

Eichhorns start their formation landing. Touch down, thunderous applause!

The "contrails" that Walter and Toni draw in the sky during their air show make it easier for the spectators to follow their figures, they are a kind of "short-term memory" of the flight path. The disadvantage is, that even for non-professionals, it is easy to recognize improper flying figures on these stripes, e.g., egg-shaped loops. But the contrails also help the two pilots to recognize each other better in the sky when they fly separate maneuvers and want to meet again for formation! By the way, these contrails are not smoke or engine exhaust or burnt engine oil, but vegetable wax oil, which is carried in extra tanks and injected into the hot exhaust jet. There the vegetable wax oil evaporates (not burns!) and creates the contrails. The vegetable wax oil can also contain dyes, then the "contrails" become red, blue, green or yellow. However, the color pollutes the aircraft considerably and was not used by Walter and Toni after a single, very cleaning-intensive attempt. According to the current safety data,

kerosene wax is classified as harmless to humans and the environment in accordance with directives 67/548/EEC or 1999/45/EC and regulation (EC) No 1272/2008.

Author Michael Linke became interested in aviation since kindergarten. A glasses wearer since he was ten years old, a career as a professional pilot was not possible back then (1970), though now he has been a private pilot for 50 years. He writes and photographs with his own company for 44 years and is now retired.

On February 12 of this year, Walter was officially accepted in the Alte Adler (Old Eagles), an association of personalities who have rendered outstanding services to aviation and aerospace through special flying achievements in the civil and military fields, as well as researchers, scientists, designers, teachers, historians, publicists and promoters. For about 90 years, "Alte Adler e.V." has accompanied and promoted air sports, aeronautical projects. With their commitment to the preservation of tradition, the Alte Adler make an important

contribution to securing the future of air sports and ensure that the history of aviation is not forgotten. NATA congratulates Walter on this achievement. He recently sold his T-6 to Redbull. – The Editor



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