The Value of Practicing Slow Flight

Although I am not a flight instructor, I have been a pilot for many years including first flights, flight testing and occasionally helping both pilots and non-pilots land for the first time in RV's (many in the RV-12). One of the keys to success landing an airplane for the first time or after a number of months, possibly years away from the cockpit is mastering slow flight. I have flown numerous designs from early era bi-planes to fast cross country cruisers with comparatively high stall speeds. To become familiar with any aircraft before landing for the first time I always practice a slow flight routine. I cannot stress the value of this exercise enough. Over the years I have talked to a number of students or rusty pilots who mention their landings are poor and I ask, "have you done any slow flight practice lately?" The answer is almost always "No" or "I just fly in cruise A to B then land" as if landing is the afterthought of flying when in reality, perfected landings can become one of the most satisfying occurrences each flight. My follow up question is always the same, "how fast is your approach speed?" Pilots avoid slow flight because it makes them feel uncomfortable, but when we are landing, slow flight is exactly what we are executing close to the ground where there is less margin for error.

Speed on approach seems to make pilots feel more comfortable. With practice pilots may even have the false impression they are proficient, when in reality high landing speeds are a symptom of insecurity with an airplane and underlying problems. A primary problem is energy which increases with the square of the speed. An aircraft landing at 55 knots has 50% more energy than an aircraft at 45kts. An aircraft at 65kts has 200% more energy than at 45 kts! All that energy must be dissipated when an aircraft comes to a stop. Brakes dissipate this energy as heat and in a crash the airframe may crumple but the goal is to transfer the least amount of energy into the occupants of the aircraft. Slow flight in an emergency will let you land with the least amount of energy and may allow you to control the aircraft into a more favourable landing area.

Speed also causes students to overshoot their anticipated landing point. As the pilot begins the flare a reasonable distance above the ground the aircraft balloons up several more feet in the air. The original landing point is now far behind the aircraft. In most cases, the pilot will realize what is happening, recover and gently pitch forward to a lower angle of attack as the speed bleed off, then flare a second time at the proper speed. In some cases, the student may continue the flare after the aircraft balloons and as a result the aircraft stalls well above the ground and "drops in." We know from ground testing that aircraft with structural failures have dropped in from a significant distance.

In the sports world after an amazing performance some athletes mention, "everything slowed down… I could see things before they happened". A low time student pilot may not have the ability to enter the "zone" which comes from focus and years of practice, but they can significantly slow the sequence of events during landing. The slower an aircraft is flown the more time a pilot has to react. This is one of the details (such as properly trimming an aircraft) that will make the difference between a fulfilling day of flying or a student left to wonder if they possess enough of "the right stuff". If slow flight has been mastered a student should feel in control and comfortable above the runway. They should be able to land the aircraft at a predetermined touchdown point. The danger lies in a student who tries a slow approach and landing without first mastering slow flight at altitude. Helping build the Future of Aviation in Australia Page 2 of 4 The aircraft loses energy, they flare and stall too high. The aircraft bounces in for a hard landing. The student is now wary or even afraid of flying slow. Instead of focusing on slow flight practice the student solves the problem with a much higher approach speed followed by long distances above the runway bleeding off speed until it is possible to flare without ballooning. The only thing mastered here is the ability to flare slowly, but

this method of landing is not safe when the eventual emergency occurs. This problem has limited many pilots to operations at airports with large runways, but engine failures are indiscriminate of runway size.

Sadly, in recent years there has been an increase in the number of fatalities from engine failure followed by a loss of control. Slow flight was an area of the envelope possibly never practiced. An airplane will fly much differently without power. The difference between idle thrust and a stopped propeller creating drag is immense. A pilot that is unfamiliar with how their aircraft handles at low airspeed will not recognize the cues given to them by the aircraft as it nears the point of losing control. Pilots who were afraid to fly slow or practice stalls are now thrown into the experience with no experience. The closest analogy that comes to mind is a gambler who has by poor choice stacked the odds against themselves. Who would do that? If you were offered the opportunity by a casino to stack the deck in your favour, would you? Who wouldn't? By practicing slow flight, you are stacking the odds in your favour.

One important factor not to be overlooked is the addition of an AOA (Angle of Attack system) with tone warnings. One popular EFIS manufacture has reported 0 fatal accidents from loss of control (LOC) for AOA equipped aircraft with and tone warnings activated. Although there are not a large number of such AOA systems yet in use this is still a compelling statistic. A properly calibrated AOA is a great tool to pair with slowflight practice. If you already have an EFIS system AOA can in most cases be added for little cost (we install a blind rivet with the mandrel removed on the lower surface of the leading edge which is connected to the EFIS using standard tubing). You may think "I have never needed one" and "I can land just fine, so why add AOA?" … but then be honest and ask your self how many engine out experiences have you had? For many of you thankfully that number is zero. We hope it stays that way, however the reality is it can happen and for what is now a significant number of accidents LOC after power failure has resulted in avoidable fatalities. A significant percentage of pilots who maintain control into the crash have survived. By looking at the wreckage you would never guess they would have lived but by staying in control, maintaining critical speeds gave them the best odds of survival. AOA can add one more level of defence when distractions are taxing the pilots bandwidth allowing the pilot to remain in control.

I have had many memorable moments flying with Van over the past two decades on the way to Oshkosh. It seems they always pair us together since few co-pilots use the word "fun" and calculating subjects such as the relative per passenger efficiency of the RV-10 and a Boeing 737 in the same sentence. We were flying in the RV-10 with a journalist writing a story about the aircraft. Van let the reporter take the controls who was on approach for runway 13 at KABR Aberdeen South Dakota. He was high, still close to pattern altitude and had let the airspeed increase significantly on what most people would consider just outside a close approach. At best we would be landing on the second half of the runway or most likely going around. The prospect of a long taxi back to fuel and the possible poor impression of the airplane I could tell was testing Van more than the landing was Helping build the Future of Aviation in Australia Page 3 of 4 testing the reporter. Van offered to take the controls, which the reporter readily handed over and what happened next was a moment that inspired me to become a better pilot. Van slowed the aircraft which entered a steep yet perfectly controlled slip. Any excess forward speed would cause us to overshoot our objective. There are no approach chevrons for runway 13. In a heavily loaded RV-10 we flared and touched down just past the threshold and easily made the first turnoff without braking which is at the 825 ft mark. Does Van possess superhuman skills? Professionals make the difficult seem effortless and the one common thread between them is practice. Van controlled the most important variable airspeed safely inside

his own personal operating envelope. With surprisingly little time spent in practice we all can expand the envelope inside which we are comfortable.

Practicing slow flight is to flying as scales are to a musical instrument. You are not playing an exciting melody but there is no better way to learn the motor skills required to master an instrument. I start practice with a student 20-30 kts above the approach speed making 360 degree turns left and right at no more than standard rate. Most likely as a student this was your very first manoeuvre, but did you know it was also a very important one? I am not passing off the shallow banked turns as a formality leading to the later "real" work controlling steep turns but rather focusing on full control while perfecting the slow shallow banked turn. When the student has shown proficiency at an airspeed, I will drop the speed 10-20 kts lower (how much depends on how well they flew the last sequence). As we near the stall speed I will drop speed in 5kt increments. For example, in the RV-12 this would be possibly 80kts, 70 kts, 60 kts then reducing to 55kts, flaps down and 50 kts and finally 45kts (if lightly loaded with flaps deployed). If the student is a pilot and used to the concept of a stall, I will follow this with a couple stalls left and right in a shallow bank. Do not simply stall straight ahead. Many pilots fear stalling in a bank and the point is to remove their fear of slow flight. It may take an hour or more and possibly for some multiple sessions to work through this progression. Do not move on to a lower airspeed until some level of proficiency has been achieved! After the turns next practice extended side slips at an approach speed of 55 kts flaps down. While maintaining airspeed require the student to aim at a straight line (such as a road far below) to simulate the runway without deviating left and right. At this point most pilots and even those who have never flown before will have gained a reasonable level of confidence. Next try your first landing. Most students will have great results after such a routine. If after a couple landings the situation regresses go back and practice the lower end of the slow flight routine. Like practicing scales on an instrument this is boring work compared to other areas of flight but there are no shortcuts to proficiency, practice is the only answer.

I remember one student in particular who had flown many years in helicopters before transitioning to fixed wing. He had purchased a Cirrus and had asked to try out the RV. He was struggling with his landings and wondered if I could I give him any pointers. His problem I quickly determined was an aggressive pitch up in the flare, followed by a dance between lowering the nose and recovering with perfect timing or falling in. He was reacting to seeing the ground coming up in front of him much as a helicopter pilot would at the end of an autorotation. We started with slow flight turns as previously described but this alone did not break his habit to come in with extra speed and rapidly over-control the flare. To solve this, I demonstrated slow flight at a long runway, behind the power curve (using power to keep the airplane aloft), just above a stall, flaps down 2-3 feet above the Helping build the Future of Aviation in Australia Page 4 of 4 runway. I then had him fly the same routine without landing. We would fly 2/3 the length of the runway then go around. In the end he had confidence to use pitch and power together to safely flare and land the aircraft. This is not something for the novice pilot to try but as your skills increase try practicing this first in calm conditions. This skill set will become very useful in high wind situations where the aircraft does not want to settle down on the runway. I keep my aircraft at the mouth of the Columbia Gorge where winds during the fall and winter can typically be 20+ kts gusting over 30kts. Landing is not just a formality or survival but has become a challenge I enjoy. I will ask for a long landing then practice flying half of the runway length at a constant, low but safe altitude above the runway before settling down just before my turnoff. Part of the key to becoming better is to grade yourself and find ways to learn and improve with every landing. If you are comfortable with slow flight, landings will become a welcome and rewarding end to each flight.

Although the slow flight routine described above is simple, we realize there are many skills to learn on the road to a pilot's license or transitioning into a new or higher performance aircraft. For many years we have offered professional transition training for our aircraft. We believe this is a major factor in Van's Aircraft having a leading safety record in the kit aircraft industry. We encourage students, pilots and instructors to take this training. We all can benefit from instruction that challenges us.

Remember back as a kid at the end of a runway, the fascination watching airplanes land. Remember your first solo, how satisfying that first landing was alone. Remember the days when shooting touch and go's was fun. Take pride in your landings. Become confident with your aircraft in a wider range of the envelope. Hope is not a plan. Your safety and the safety of you passenger(s) will depend on it.

For those of you wondering, the per passenger fuel efficiency gallons/passenger/mile of a 737 loaded with 100 passengers and a RV-10 loaded with four passengers is surprisingly similar. If you found that answer using Google that is cheating since there is no internet over eastern Montana when Van typically brings these questions up … and yes, I am still waiting for my half of the bargain, a ride in the Cirrus. Somehow, we ran out of time flying the RV without getting that in…and neither one of us seemed to mind.

Fly safe everyone.

Rian Johnson