THE STABILIZED APPROACH

BY

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Once upon a time, a Baron pilot broke out of the clouds at 300 feet and saw a runway directly in front of him. Unfortunately, he was going about 140 knots and he had his gear and flaps up.

"I'm not goin' back up in the clag," he thought to himself. He dropped the gear, put the flap selector to the full-down position, and did a couple of "s" turns to try to get the airplane slowed down to a speed at which it would not balloon back up into the clouds when he attempted a landing flare.

He got the wheels on the ground about 2/3 of the way down the runway, clamped on the binders, and got it down to a speed where he was able to screech around the turnoff at the end of the runway, getting it stopped on the taxiway with only a blown tire to punish him for neglecting to organize his approach more effectively.

A second story is that of a lady who had just passed the test for her private pilot certificate. She told me that she didn't think she was in any way prepared by her training to be a safe pilot. She asked me if I would be willing to "teach her to fly," now that she had her private ticket.

This person, a high-achieving neurologist, was married to a Bonanza pilot who flew all over the country with her and the kids, mostly for family vacations. I suspected that part of her problem was that she was comparing her newly-rated pilot skills to his instrument-rated, highly experienced airman abilities.

So I went flying with her. We flew up to rural Mississippi, where a friend of mine had a landing strip on a farm that he owned. We flew over the strip about fifteen hundred feet above the ground, and I told her to land.

She gave me a frustrated snort, turned in toward the field, and flew a pass down the runway at about a thousand feet. She then flew out away from the field and told me she had no idea how to get the little Cessna on the ground on this three-thousand foot paved runway.

Subsequent conversation with this private pilot revealed that she had very limited experience landing on runways not at her home airport, and that she pretty much used standard landmarks around that airport to judge her landing approaches. In other words, she had been taught to land by rote. She had never learned the elements of an organized landing approach, much less how to make the transition from cruising to landing.

One answer to the problem posed by these two pilots, an answer that comes to us from operators of heavy jets, is to fly what they call a stabilized approach. The object of such an approach is to have the airplane properly configured and to arrive at a point in space, on final approach to a runway, at the correct speed and height so that a normal landing can be made. I would add to this description that the airplane should touch down in the first third of the available landing area in a normal landing attitude, with an appropriate drift correction applied to keep the main landing gear wheels astride the centerline, moving at a well controlled touchdown speed, allowing the machine to be slowed to taxi speed at or before the desired turnoff without the need for excessive braking.

One thinks of a well-executed instrument approach. While the pilot flies the intermediate segment of the approach, he executes his pre-landing checklist. By the time he gets to the final approach fix, he has slowed the airplane to whatever speed he wants to use for the final segment of the approach, the flaps are set to an appropriate deflection, and the airplane is trimmed to maintain the desired speed. Many pilots like to extend the landing gear when they reach the final fix. This provides enough drag, in most airplanes, if they are pitched down to maintain airspeed, to keep them on the glideslope without much change in power and little need to retrim. It also helps to remind them to get the rollers out into the breeze in a timely manner.

The speed used for this part of the approach may be determined by this operational question: "How fast do you want to be going if you break out of the cloud bases at minimums, perfectly aligned with the runway, about a quarter-mile from touchdown?" A rule of thumb is to fly the final approach segment somewhere around 30% above flaps-down stalling speed.

A perusal of the Practical Test Standards for the Private and Commercial Airplane ratings mentions the stabilized approach at every opportunity. The verbiage is identical as this subject is mentioned in the "objective" section of several tasks:

Maintains a stabilized approach and recommended Airspeed, or in its absence not more than 1.3 V_{so}, +10/-5 knots, with wind gust factor applied.

In the Practical Test Standards for the Instrument Airplane rating, the Area of Operation: INSTRUMENT APPROACH PROCEDURES says:

Establishes a stabilized approach profile with a rate of descent and track that will ensure arrival at the MDA prior to reaching the MAP.

Allows, while on the final approach segment, no more Than a 3/4 –scale deflection of the CDI or within 10^o In case of an RMI, and maintains airspeed within +/- 10 knots of that desired.

In the case of the ILs approach, the Objective section lists:

Maintains a stabilized final approach, from the Final Approach Fix to DA/DH allowing no more than a ¾ scale deflection of either the glideslope or localizer *indications and maintains the desired airspeed*

Within +/- 10 knots.

So now we have a few parameters of the stabilized approach, as defined by the FAA. When I was conducting instrument tests, I advised the applicants that the "desired airspeed" meant whatever speed they were indicating when they passed the final fix inbound. You could make a good argument for 1.3 Vso, as a workable break-out-of-the-clouds speed.

One applicant I flew with in a Cessna 172, the 18-year-old son of a veteran pilot and flight instructor, initiated his final descent on the ILS approach indicating 100 knots, steady as a rock. As he passed through 500 feet, he started decreasing his power, while maintaining localizer and glide slope indications, right on the money. The airspeed started bleeding down until he had 70 knots on the clock just as he hit his decision height: a superb display of aircraft control, although it did not meet the standard. There was no doubt that he was doing this on purpose, and I thought it was an impressive example of stick-and-rudder airmanship. I filled out his temporary certificate with a big smile on my face.

There's more than one way to skin this cat, for sure, in light, general aviation airplanes. Heavier transport aircraft are highly constrained by their inertia. It is much harder to make adjustments in these airplanes, once they are established on the final approach segment. The pilot of a hundred thousand pound big iron bird is well advised not to try such transitions. Clearly, it takes a while for such a pilot to affect much of a change in airspeed or angle of descent without seriously messing up the operation as the touchdown comes near. This is not true of light planes, which accelerate much more readily.

I had another memorable experience a few years later, flying with a fellow in a Seneca. The two of us were flying to Hammond, Louisiana and he was acting as pilot in command. As we came up on the airport, we were descending for landing with the gear and flaps up and the speed near the yellow arc.

I remember thinking that he was probably going to overshoot the entire airport.

We got to pattern altitude a few miles out, and he started reducing the power. Soon he was down to gear speed, and he threw out the rollers. Then the airspeed reached the white arc, and he put out the flaps. He crossed the fence at around eighty knots and put us down about twelve centimeters past the numbers, turning off at mid-field without hardly having to use the brakes. Well, I thought, sometimes you luck out…

On the return flight to Lakefront Airport in New Orleans, he made the same kind of kamikaze approach, with the same result. Twice in a row ain't luck.

When we got the airplane secured, I brought up the subject of stabilized approaches. I told him I noticed that he never had acquired a steady approach speed, and remarked that the way he had done his landing approach seemed kind of haphazard to me.

He replied that we were flying in a twin, and that he'd prefer to "maintain his energy," as he put it, until he had the runway made. He had done both approaches like that on purpose, and yes, the technique maintained us in a condition where an engine failure during the approach would be strictly a no-sweat proposition. Furthermore, this bird cost a lot of money to operate, and the only excuse for going anywhere in an airplane is to get there fast.

In subsequent days I thought a lot about his technique, and the more I thought about it, the more I liked it. Come to find out, this gentleman got his initial introduction to flying in the Army, flying helicopters. In a helicopter, you don't set up a landing speed and descend toward a flare point. You drop the thing in at a constant angle, maintaining a combination of speed and height that would allow for a safe autorotation in the event of engine failure during the approach. In fact, fling-wing pilots have little graphs called *H/V curves*, "H" standing for height above the ground, and "V" standing for indicated airspeed.

When you're coming in for a landing in a helicopter, you have to keep the proper combination of speed and height, which would represent potential and kinetic energy, so that you could keep the rotor turning fast enough, in the event of engine failure, to flare near the ground and make a touchdown that wouldn't crunch the skids.

For example, if you're in a hover 15 feet above the ground and the engine quits, you're pretty much going to fall 15 feet and bend the Reynolds Wrap when you hit the ground. But if you're going forward at, say, 40 knots when this happens, there will be enough air passing through the rotor to keep it turning, giving you some kinetic energy in the rotor to work with when you reach zero height and need to pull pitch.

When you think about it, there's some logic to that kind of approach that transfers to flying airplanes, especially twin engine airplanes. To keep the critter under control with an engine out, you have to keep your airspeed above some value that gives the rudder enough authority to keep you from yawing uncontrollably into the dead engine. If you're too low and slow to get to this speed, you're plumb outta luck. You're either going to have to reduce power on the good engine and live with the resulting sink, or you're going to have to trade some altitude for airspeed. If you're slow and close to the ground, both of these approaches are iffy. You may find yourself as out of control as the hapless plunging helicopter pilot.

Clearly, making this kind of approach successfully requires a certain amount of planning ahead and skillful execution. But shouldn't pilots always be trying to improve their skills so as to do the best, safest job of keeping the aircraft under control? And if the result is arrival over the fence at a workable altitude and airspeed, can't we say that this pilot has made a stabilized approach?

When I started to learn to fly in the early '60s, we had a doctrine of chopping the power all the way back to idle when we were passing abeam our putative touchdown point, on the downwind leg. Then we'd glide in and make a graceful landing beyond and within 200 feet of a designated point on the runway, usually the numbers.

In the early stages of training, the beginners were told to pull carburetor heat and close the throttle at the so-called *high key* position, on downwind leg, opposite the hoped-for point of touchdown. Then they were to wait a decent interval and turn base, usually when the touchdown point was about 45° behind the wing. When they had gained some experience and had developed their judgment some more, they would be encouraged to be flexible about where to turn base, based on how hard the wind was blowing.

Rolling wings-level on base leg, they would find themselves at the *low key* position, where they were supposed to make a judgment as to how things were going. There were only three options: too high, too low, or just right. If a student couldn't tell for sure, he was probably pretty close to just right.

If he judged that he was a tad high at the low key, he'd turn a little bit out away from the runway to widen out the pattern and burn off some of that extra altitude. He might even overshoot the final approach course and make an "s" turn back to final. This technique would serve him well if he ever found himself wanting for horsepower following a problem with his engine. If he thought he was low, he'd turn in toward the runway and hope for the best. If all else were to fail, of course, he'd have to add power to make it to the flare point over the runway. That was sneeringly known as airplane driving, not to be confused with piloting.

Throughout this process, the student was encouraged to hold a pitch attitude that would result in a reasonable approach speed. By the time he turned final, he should have established himself within a cone-shaped area where he could glide to the runway and land past the threshold and no farther than one third of the way up the available landing area. Using this procedure gave a nascent pilot limited options. He was encouraged to make constant judgments throughout the approach and to act on those judgments. Emphasis was placed on holding a pitch attitude that would result in a reasonable approach speed, not on chasing a reading on the airspeed indicator. Instruction about the use of flaps was often delayed until after the initial solo flight.

A little farther into the ‘60s, someone decided it would be a good idea to teach Cessna 150 students to make something called a *power approach*. This practice was supposed to have the advantage of training the student in approach techniques appropriate to twins, jets, and other high-performance flying machines. You never know when you’re going to be called on to land a Lear jet or a Boeing 777 [although I understand that the guys who fly *really* high-performance equipment, like space shuttles, have reverted to the power-off approach].

There followed a period of teaching a “drag it in” approach, with partial power working against the drag of partial flaps, it pretty much didn’t make any difference how you flew the pattern, and height/distance judgments became less important. What you’d do was reduce power and extend some flaps at the high key position. Then you’d drive out over the countryside to a location where you had plenty of room to maneuver, presumably keeping the runway more or less in sight. The flaps, according to this mode of thinking, would come out at some predetermined point in the approach, regardless of how things were progressing. The numbers my instructor gave me were, 1700 RPM at high key, confirm speed in the white arc, and extend 20° of flaps. Put down another 10° of flaps at the low key, and the last 10° when turning final. Eighty miles per hour was the target speed until you got near the flare point.

If you found yourself on final approach a little far out, a frequent occurrence for airplane drivers, that was okay. You just squeezed in a bit more power and drove the bird in a little closer. Power could be added or subtracted as the mood moved you, but you were to adhere slavishly to some airspeed, from the high key all the way to the flare. Somewhere along the way, you'd reach a point at which you thought you could glide to the runway with full flaps, then you'd close the throttle and land. What the hey, modern engines seldom quit, and these elongated approaches were easier on the equipment. Making long patterns didn't involve so many touchdowns and liftoffs per flying hour, and the instructors and school operators made more money, since it took their students more flying hours to achieve any particular level of competence. Thus was born the concept of the "stabilized approach," applied to airplanes grossing out at 1600 pounds.

Defining the term often involves the practice of invoking the opposite: "An *unstabilized* approach is …" And we get to talking about changing airspeeds, power fluctuations, and deviations from a steady glide path. These haphazard changes in landing approaches, it seems to me, are the meat and potatoes of the power approach.

However you perform your approach to a landing, in whatever kind of flying machine, you should be making a continual analysis of how the approach is developing. Whether you are trying to hold a constant airspeed, a constant pitch attitude, or a constant angle of descent, the goal is to arrive at the flare point at the right speed, in the right configuration, and with the right crosswind correction to make a smooth landing and to exit the runway without having to use excessive braking. Clearly, an abandoned approach and a go-around is in order any time you judge that things are not developing toward that goal.

Then set up a *different* set of conditions at the key positions of the next approach, correcting for the errors that probably led to the unstabilized approach you had to abandon.

Then you may quit seeing the tire salesmen, the brake puck salesmen, and maybe even the guys in the meat wagon rubbing their hands together every time they see you coming.