Finding the Optimum Final Approach Speed

There are a handful of mistakes that nearly all recreational R/C pilots make that stem from not having a plan before flying. This article is aimed at addressing the two bad habits that probably lead to more damage during landings than any others. Indeed, most pilots will immediately experience improved landings if they can correct just one of these two bad habits.

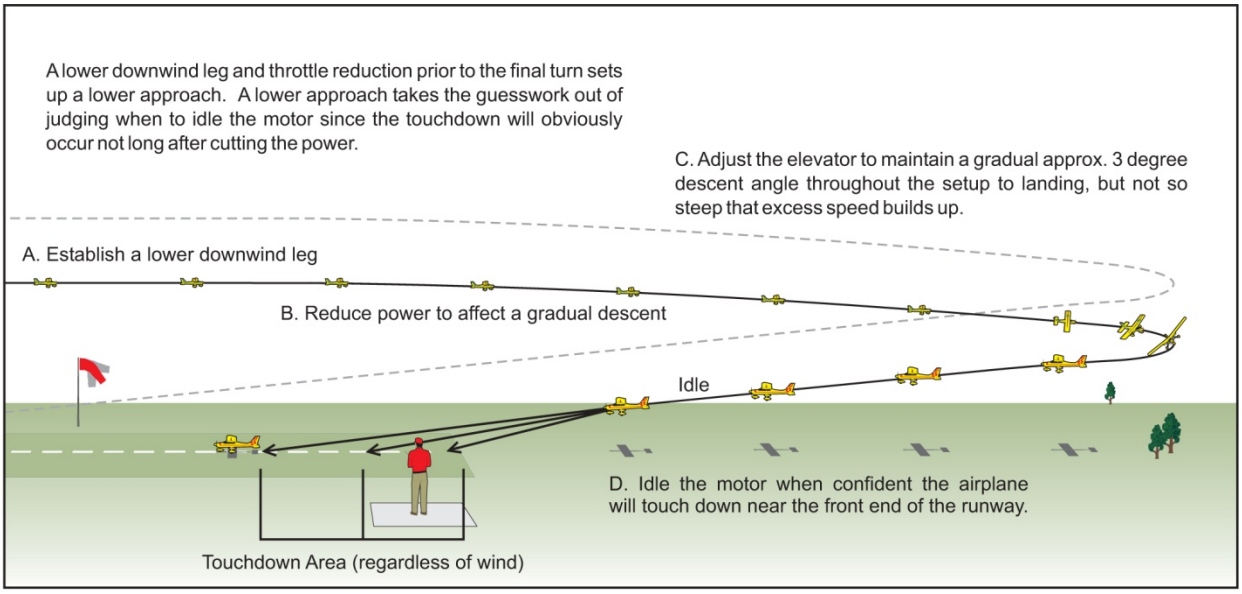
Landing bad-habit #1. Diving to the runway

The first bad habit goes back to the way pilots set up their landings when they learned to fly, and it's the reason why no two landings ever go the same since. Most pilots never give thought to flying a specific landing pattern to set up a landing. Instead, they loosely fly downwind, turn around, and try to get lined up and lose altitude before arriving over the runway. Of course, novice pilots would have been flying higher to stay safe, so when the decision is made to land, they are forced to let the nose drop appreciably during the base leg turn in an effort to lose the excess altitude.

As a consequence, the airplane comes out of the turn carrying too much airspeed. Approaching the runway too fast can been seen at clubs across the country in the form of pilots having to perform multiple go-arounds because they can't get the airplane on the ground without flying or rolling off the end the runway. All too often, frustration and concerns about fuel or batteries running low causes pilots to then try to force the airplane onto the ground at the higher airspeed with the elevator. As a result, even the best flyers in the country would have a hard time touching down smoothly when carrying too much speed -- since the tiniest imperfection during the flare will lead to a balloon, a major bounce, gear damage, or worse (usually followed by blaming the manufacturer for not making the gear/plane strong enough). Similarly, we've all heard pilots complain about high-lift airplanes having a tendency to "float", and yet, unless they figured out a way to switch off gravity, a slow flying trainer should be easy to land in less than 50'! Of course, the reason for floating is not the airplane, but letting the nose drop too much and building up excess speed.

Flying too high on the downwind leg and the resulting preoccupation with trying to lose the excess altitude is also the #1 reason why pilots struggle to line up with the runway centerline, and thus often end up needing to make last moment corrections followed by a poor flare. Conversely, if a pilot is less consumed with trying to get the airplane down, he'll be able to focus more on his surroundings and judging whether the plane is lined up, thereby making the flare much easier. Surely you have noticed how much slower things seem to happen and how much easier the landing is when the plane arrives over the runway perfectly lined up!?

Thus, an essential key to setting up better landings is paying attention to flying a lower downwind leg in advance of the turn to final, thus freeing you up to focus on positioning and coming out of the turn perfectly lined up with the runway. The combination of a good lineup and not fighting to lose altitude will then also afford you more time to think about when to idle the motor to affect a touch down near the front end of the runway (figure 1). Understand that it is standard practice to let the airplane descent slightly before, during, and after the turn, but too avoid building up excess speed, don't let the nose drop more than a few degrees. Lastly, if the airplane is not coming down at a sufficient rate to touch down near the front end of the runway, rather than dropping the nose more, a proficient pilot will reduce power to affect a steeper descent without building up excess airspeed.



If turning lower to the ground is something that you're not comfortable with, it would be wise to acquire a more forgiving airplane and work on your fundamental turning technique. Remember, the plane doesn't know what altitude it's at, so if you can perform a reasonably level turn at altitude, you should be able to do it just as well closer to the ground.

#2. Approaching too fast

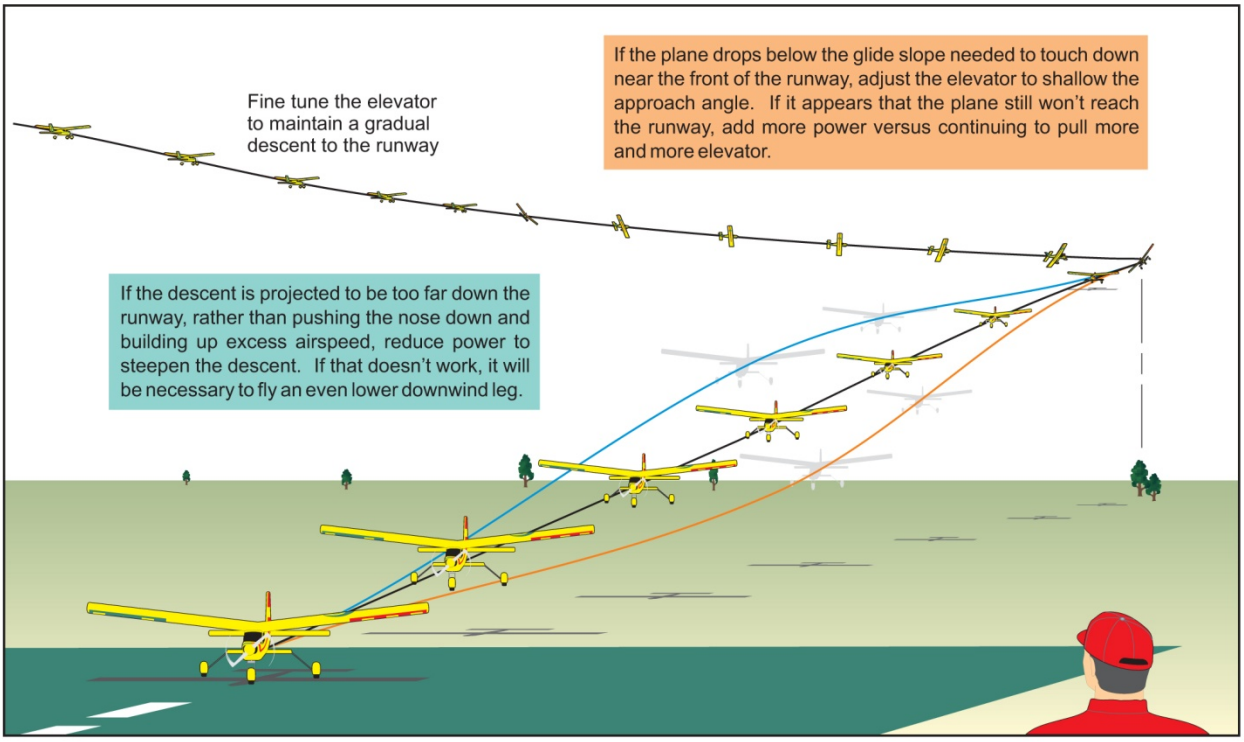
The next common landing mistake occurs after pilots are warned to keep up enough flying speed during the landing to avoid stalling, i.e., don't let the airplane get too slow on approach to landing. Since these warnings usually come from people who in the past let a model get too slow and crashed, the recipient of this advice usually takes it to heart. The 64 million dollar question is, "how do you tell what the right approach speed is, or, how do you tell when the model is getting too slow?"

The reality is that due to varying wind speeds and directions, differences between airplanes, weight, and even the effects of temperature on airplane performance, there is no consistent answer and you won't be able to tell by appearances. For example, when flying into a strong headwind, a plane can have plenty of flying speed and yet look too slow, thus prompting a pilot to unnecessarily add more power and subsequently struggle to get the plane down. Or, it's quite common for pilots to stall during landing and blame the crash on a gust of wind rather than a stall because the plane "had plenty of speed," when in fact they were landing downwind. Of course, if you always flew the same model in the same conditions (e.g., early mornings in calm winds), you could learn what the proper approach speed looks like, but for most that's not the real world.

In light of the unknown, many pilots will tend to err on coming in for a landing with extra speed, especially when flying a new airplane, or after being told that it is safer to land with more speed anytime there's wind. Once again, instead of being safer, carrying extra speed makes the landing exponentially more difficult and less forgiving. Plus, even if the plane does touch down smoothly, the odds are greater that it will still carry off the end of the runway! Indeed, the author has seen countless landing mishaps when the concern about rolling off the end of the runway became more important than touching down smoothly. The fact is that far far more landing gears are torn out each year because of carrying too much speed than because of getting too slow.

Consequently, just as all full-scale pilots are taught, it is preferable for the airplane to touch down at the slowest possible safe airspeed. Not only does a slower approach shorten how much runway is used, it lessens abuse on the airframe and minimizes any bouncing if the touchdown is less than smooth.

As a rule, the elite pilots who make it look easy use the same general landing procedure regardless of airplane type or wind (figure 2). First, we'll establish a lower downwind to make it easier to control the eventual touchdown location. A throttle reduction is made on the downwind leg to begin a gradual descent while typically holding in and adjusting a small amount of up elevator throughout the landing setup to manage a gradual (approx. 3 degree) descent. Then, when we're confident that the plane will make the runway, we'll reduce power to idle or close to idle.



So how do you judge whether the plane is getting too slow, since you can't judge the planes true airspeed by looking at it? The answer is that no matter what type of plane you're flying or what the wind is doing, the best way to determine whether the airplane has enough flying speed or is getting slow is by "feel." As most of you know, a wing will start to stall (lose lift) when the angle-of-attack becomes too steep relative the flight path, and consequently the airflow no longer remains smooth over the wing. A high angle-of-attack stall is typically preceded by the pilot inputting more and more up elevator, usually to try to keep a slow or steep turn from descending too quickly, or to extend a glide. Stalls are therefore almost always preceded by the pilot pulling increasing amounts of elevator. Thus, regardless of how slow or fast the airplane appears, if you ever find yourself having to add more and more elevator in a turn or on final approach, and are urged to keep pulling more, don't! You are likely on the verge of stalling and need to reduce elevator and/or add power to keep from spinning into the ground. Conversely, if you're not having to hold in any up elevator throughout the landing setup, or sense the need to push forward elevator to steepen the descent, you can be certain that the plane is flying too fast.

Space does not permit going into all the details, but some might be interested to know that many of the loss of control mishaps that occur during landings that are attributed to getting too slow or gusts of wind are actually caused by adverse yaw. I.e., Adverse yaw becomes more pronounced at higher angles of attack, especially when the airplane features a high-lift flat-bottom airfoil wing. Thus, many pilots who encounter control problems during landing--and therefore think they need to land faster--actually need to mix or learn to coordinate some rudder with their aileron inputs.

With all that said, the single best thing that pilots can do to mitigate these problems is so simple that it's often overlooked. That is, rather than trying to guess what speed to land at, take the airplane up to a

safe altitude and slow it down until it stalls. It's always a thrill to test fly a student's new airplane and watch his nervous expression change to optimism and confidence when his plane displays milder than expected stall characteristics and remains fairly controllable even with full up elevator held in. Conversely, another model might display a sharp tip stall tendency and a subsequent rapid loss of altitude until the elevator is reduced. While that may not sound very comforting, it reduces the fear of the unknown and thereby does add to the owner's confidence to at least know what he's dealing with before attempting a landing.

The notable exception to the standard approach procedures described above applies to anyone flying a very lightweight park flyer or foamy. Since very lightweight airplanes have less inertia, completely shutting off the power during a landing can result in the loss of nearly all forward momentum, and thus a loss of control due to the lack of airflow over the control surfaces. You should, of course, test this at a higher altitude before attempting a landing. As a rule, lightweight models require the throttle to remain above idle nearly all the way to the ground while using the elevator to control the descent rate. Just remember that this technique is specific to landing very light airplanes (and 200 mph Starfighters) and you'll have to literally switch approaches when transitioning to more conventional airplanes. Happy landings!