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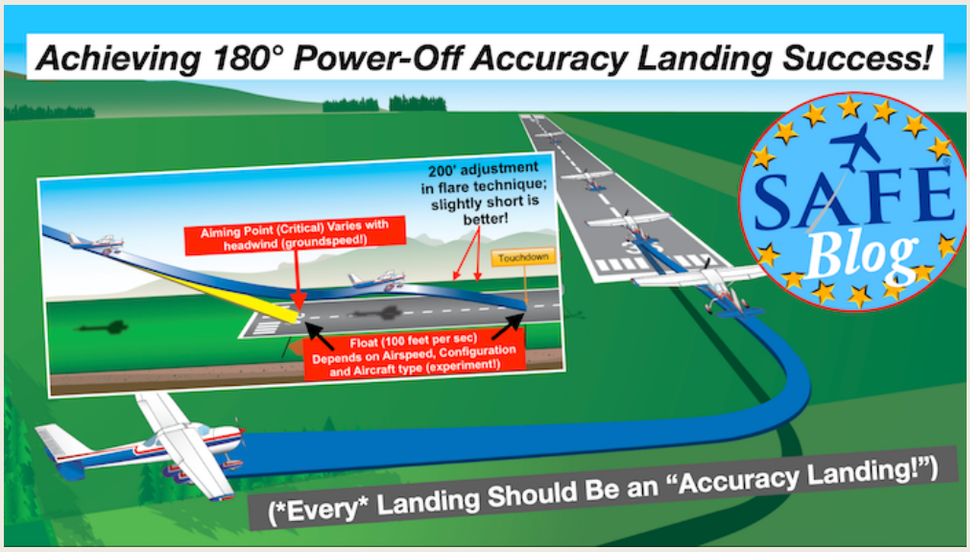
Commercial 180° Power-Off Accuracy Landing



David St. George

September 2, 2023

CFI Technique

The "power off, 180-degree accuracy landing" defeats many commercial flight test applicants. It is a high bar; managing the aircraft's energy to elegantly land on a point within 200 feet. Many disappointed candidates report unhelpful advice from their CFIs in training this maneuver, and serious disparities in what DPEs define as "success."

The burning qualification questions seem to be "Is this a 'one try' maneuver?" and "Can you slip despite the requirement for a stabilized approach?" Remember this maneuver is just the more demanding form of a normal landing and all landings should be accurate and on a

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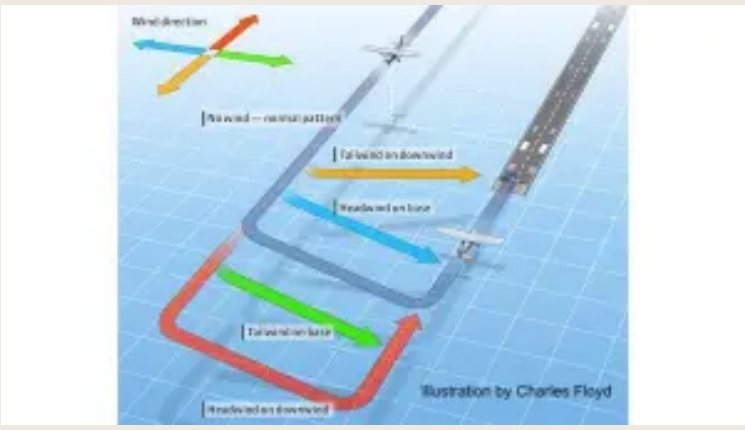
- Educational Excellence predetermined aim point. Here are some pointers to make every landing better and the 180° power-off accuracy landing easy.

The Power-Off 180° Is a Logical Extension of a "Normal Landing!"

First, it is important not to overcomplicate this maneuver. *Every* landing should be to an accurate aim point, right from the first solo. As we progress as pilots, we should be continually sharpening this skill to be more precise. And having power available often just corrects for poor judgment or sloppy flying so this is an "opportunity to learn." Let's unpack this and give you tools to make this maneuver predictable and consistently successful.



First Determine What Your DPE Wants/Allows

The first question to resolve if this is for a check-ride is what techniques will be allowed by your evaluator during the demonstration of this maneuver; get on the same page here. Some examiners carry the "stabilized approach" criteria too far and insist on full flaps, gear down immediately, and no slipping allowed. But the FAA Airplane Flying Handbook clearly regards this maneuver as almost an emergency procedure; allowing basically whatever it takes to achieve the result specified in the ACS.

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> *Pilots may use S-turns, slips, early or late extension of flaps, reduce airspeed below best glide, or increase airspeed slightly above best glide in a headwind in order to stabilize the remaining approach, to reach the desired aiming point at an appropriate speed, and to touch down where planned...*
>
> *A crab or side slip can be used to maintain the desired flight path. A forward slip may be used momentarily to steepen the descent without changing the airspeed. Full flaps should be delayed until it is clear that adding them will not cause the landing to be short of the point. AFH*

Another critical question to resolve with your evaluator before the flight is whether a go-around is allowed for a second try. There is no specification for a single attempt in the ACS or any other current published guidance I could find. This idea first appeared in the "FAA Designee Update" (which is no longer in print) and this has occasionally appeared verbally in national DPE training. Consequently, examiners still seem to differ on this point. So make sure to ascertain what *your* DPE is looking for. The "one try" rule certainly creates intense pressure that leads to some desperate and unsafe "arrivals!" Always ensure safety in your practice with a go-around if the maneuver is going badly.

Pick the Touchdown Target and Aim Point

The first step in the successful flying of this maneuver is to pick a good **touchdown point.** This should not be the runway numbers since your "aim point"would be short of the runway, and this does not allow a safety margin if the maneuver is misjudged. The AFM is pretty clear on this.

> *Note that selection of the runway numbers as the touchdown point does not provide a safety cushion in case of a mechanical problem or misjudgment. Selecting a point farther down the runway establishes an increased safety margin.*

The second essential decision is how far your **aiming point** will be *before* the touchdown point based on the conditions of the day. When an applicant during an oral tells me they are aiming exactly where they intend to touchdown I already know we are going to be unsuccessful (there is a serious lack of understanding here or they are doing a "stall-down" landing). Basic physics demands some energy to arrest the airplane's descent and touch-down in the landing attitude. A plane traveling 60K is using 100 feet per second. A standard 3-second "float" from a co-located aim point would already make this maneuver unsuccessful.

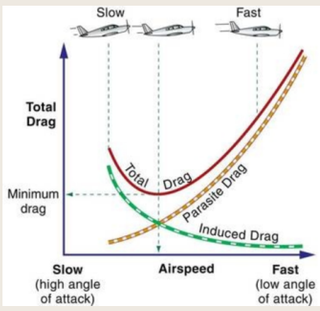
Carefully Determine Your Aircraft's Performance

Deciding the aim point will depend on the type of aircraft you are flying and the ***ground speed*** entering the level-off. Obviously, the airspeed has to be precisely controlled by the pilot, but the *ground speed* will inevitably vary with the wind conditions. So pick your aim point carefully based on the conditions of the day (closer to the point with more headwind). What speed to fly into ground effect and the amount of float are the essential data every pilot must gather and apply while practicing this maneuver to achieve a predictable result. This obviously varies with each airplane, loading and conditions; some airplanes float and some are "bricks!"

All this is energy management, physics, and understanding determine the control during the last part of the landing. This is the number one problem with most of these accuracy landing attempts. Forcing the plane onto the runway is not allowed, the **ACS specifies touching down in the landing attitude**. So depending on the wind down the runway every applicant should have a calibrated aiming point before the touch-down point. Way too much focus is put on all the other pattern procedures of this maneuver. These adjustments are all intended to achieve the proper energy state at the predetermined aim point over the runway. Ultimately every pilot should be able to fly this maneuver in any plane on any day with varied configurations and conditions.

Fly Precisely and Consistently On Speed

So starting abeam on the downwind, practice this maneuver the same way every time (whatever your technique might be). And this should not be some unusual and exotic formulation. Keep this maneuver as "normal" as possible and eliminate all the variables; just shorten the ground track to the runway for the greater (power-off) rate of descent!



One important difference from a "normal" landing is that after power reduction, is slowing to the best glide speed (and trimming) immediately. This slower speed in every plane is (by definition)is the "bottom of the drag curve." This means that a subtle +/- five knots will add drag and increase your descent rate (a very powerful expert tool). Add the first flap selection before turning base as usual, to help stabilize the airspeed, configuration, and descent rate. The base turn position is critical and determined largely by the wind down the runway (just like every landing).

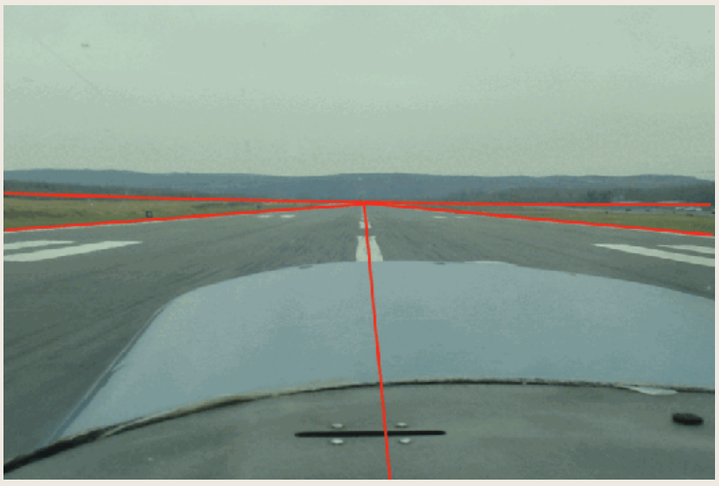
Use "Relative Motion" to Judge the Descent Trend and Use Your Ground Track to Correct Altitude.

If the speed is stabilized and the descent rate is as desired, add the second notch of flaps halfway through the base before the "key position." More important than a rote (pre-determined) altitude or point on the ground, **is the descent trend you are observing and relative motion in relationship to your aim point.** This maneuver is different every time and you will have to adjust based on observed conditions. You also may be asked to perform this at any airfield or wind condition; not just your “warm fuzzy home base airport.” Focus and adjust based on what matters: standardized configuration, stabilized descent, and the visual movement of the aim point.

> *At a stabilized airspeed and standardized configuration, carefully determine if the aiming point on the runway is moving up or down in relation to your airplane. This is the critical decision point at the key position.*
>
> *This relative motion will tell you whether you should turn toward the runway (if the point is rising and you are trending low) or high (the point is descending in your visual field and you are trending high). Fix any variations in altitude with ground track.*
>
> *At a constant rate of descent, adjusting the distance to the runway will determine your touch-down point.*

Adjust your track over the ground, cutting toward the numbers if you are low, and squaring off the base if you are high. The objective turning final is to be a little high since you have more drag available to create a higher rate of descent, and a forward slip is available if you misjudged the wind on the final approach.

Keep everything standardized and save the final flaps for the final approach, when subtle adjustments can be applied. As mentioned, the final should be slightly high since more flaps are available (meaningful repetition). But wait until you are lined up and stabilized to make this determination. If you are low at this point the maneuver is already unsuccessful.



Again: the most important data point once established on the final approach is the relative motion of the aiming point in relation to your nose picture at a stabilized airspeed. The three tools you have to add drag are more flaps, slowing your airspeed a little for more drag (raising the nose slightly), and a variable forward slip. Exercise each of these options carefully and one at a time. The objective is to smoothly reach your aim point with the proper airspeed. Everything about the commercial checkride is demonstrating smooth accurate control.

If all your adjustments have worked out, your airplane should be entering ground effect with the aiming point just over the nose, at your pre-determined airspeed (energy state). The last 200 feet should be stabilized and on speed. Remember that slipping causes inaccurate airspeed indications, so maintain your pitch attitude (don't chase the A/S) to control your energy.

The final adjustment (expert-level technique) that can fine-tune your touchdown is how you manage the flare. If you are slightly short, you can extend your distance in ground effect with a more aggressive "hold off" gaining almost 200 feet of runway: Diamonds work best for this, Cessnas pretty good, but Pipers "not so much." It is far better to be a little short for this reason and know your airplane. If you are long on the aim point or have extra energy entering ground effect, you are out of tools to create a "touchdown at a proper pitch attitude. " If this was **Air America** you could dump the flaps and other tricks. Read the **Commercial ACS** carefully for this maneuver; have fun, and practice in varying conditions. The video below is a 360 ° Power-Off Accuracy Landing, but demonstrates many of the techniques mentioned above. The "slipping turn" is a powerful tool many pilots fear (lack of understanding) but we use extensively in gliders...

And then, of course, there is the amazing Bob Hoover, with a loop, roll and landing all power-off in a Shrike Commander: **HERE**

If you make every landing an "accuracy landing," the 180 will not seem so intimidating; skill acquisition is the whole objective here. All these subtle adjustments should be what a pilot is doing on *every* landing. You do not get better with just one day or one maneuver, we should always be working to improve our skills. Fly safely out there (and often!)

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Author: David St. George

SAFE Director, Master CFI (12X), FAA DPE, ATP (ME/SE) Currently jet charter captain. View all posts by David St. George

13 thoughts on "Commercial 180° Power-Off Accuracy Landing"

Richard G

September 2, 2023 at 10:21 am

I've seen even experienced long time commercial pilots have issues. Usually it is due to misjudging the effects of wind.
On second attempt they do fine. This was observing several helicopter pilots from the rear.
The only pilot that got it right the first time was in the co pilot seat when the check pilot demonstrated it.
The problem… in real life you don't get a second chance.

★ Like

Reply

Larry K

September 2, 2023 at 10:55 am

This maneuver has almost no room for error in complex high performance airplanes. It's a decent teaching tool for precision landings and energy management in Cessna and Piper trainers but you will not be able to complete this maneuver from 1,000' in a retract and you should not attempt it. Note that the ACS does not say the maneuver must be attempted from normal pattern altitude and you should not attempt it from that altitude. We know the impossible turn is impossible at 1,000 in a bonanza or a lance/saratoga and you should be landing straight ahead so it's borderline malpractice for CFIs to instruct this maneuver in complex airplanes from pattern altitude as if the impossible turn is in fact safe. If you lose your engine in the pattern in a complex land straight ahead and make no attempt at turns. On base or final you have options but not on downwind.

I personally believe this maneuver is dangerous and should be permanently

I personally believe this maneuver is dangerous and should be permanently discontinued from the ACS because it establishes a bias that because you nailed it on your checkride in a 172 you should do attempt it in the 30 year old bonanza you bought after getting your instrument rating. Instead I think the ACS should simply require tighter tolerances on all other landings

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Reply

David St. George
September 2, 2023 at 11:05 am

Before the recent change in the commercial flight test, every pilot was *required* to demonstrate this maneuver in a retractable "complex" aircraft to acquire a commercial pilot certificate. I also recently had a client fly it in an Aerostar with both engines at zero thrust Bob Hoover's "energy management" airshow routine is instructive: https://youtu.be/tnl3JZwnUZA?feature=shared

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Ron Rapp
September 2, 2023 at 4:20 pm

There is definitely less room for error in high performance retractable, but it can be done safely. I had a student with a late model turbo Saratoga and it was much like a power off approach in my Pitts. Even on a close in downwind it would require an immediate base turn. He had to maintain a good bit of energy during the descent or there would be nothing left for the flare. I would not describe it as dangerous, but if you tried to fly it like a Skyhawk? Yes, that would be bad.

Nowadays I have an RV6 with a fixed pitch cruise prop, and it's the polar opposite of the Saratoga: it will float forever. I can barely fly a 3 degree glide slope at idle without my airspeed actually increasing, even with wing flaps fully down.

Every airplane is different. I have done power-off 180s just for fun in a Level D sim during a G650 recurrent. The challenge there was that the visuals did not extend far enough around the side to be able to see the runway, so I had to use the navigation display to judge the base turn.

–Ron

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David St. George

September 3, 2023 at 8:03 am

Following the very public flame-outs of two CItations (DEF added instead of Prist) this became part of our training at Flight Safety during recurrent. After a little training is remarkably easy to handle this situation. We usually failed at 10K over a 6K' runway. This was of course a straight-wing jet, but the same skill set applies.

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Brian Lloyd

September 3, 2023 at 11:28 am

The words "always" and "never" get bandied about a great deal in instruction. I have had no trouble doing this maneuver safely in most high-performance single-engine retracts, including the Cherokee 6 and Saratoga, which we know are basically bricks. It is all in how you perform the maneuver. The key point is that this maneuver, more than any other, is extremely aircraft-specific, and may take several tries to figure out what works. You may have to play with speeds, bank angles/turn rates, flaps, gear position, prop lever, and how aggressively you make the turn to the runway, in order to produce a maneuver that works. It would be very nice if the manufacturer helped out with this but they don't.

Interestingly, the SIAI Marchetti SF260, which I will be using for UPRT training, provides the complete high-key/low-key, engine out arrival procedure to help the pilot in this situation. (Low-key is essentially the 180˚ power-off spot landing.) It does recommend a low-key altitude of 1500′ AGL but the aircraft already has 20˚ of flaps deployed. Gear down does not happen until partway through the turn from downwind to final.

So, the bottom line here is that you need to try it to learn what works for each different type of aircraft.

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Mark Scardino

September 4, 2023 at 9:27 am

Have to disagree with you here regarding retracts. I did my trying and check for the Commercial in a Lance. Just takes practice.

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Rich Stowell
September 2, 2023 at 10:41 am

Excellent review, David! Especially the reminder about the tools available to pilots per the Airplane Flying Handbook. And especially for those of use who fly airplanes without flaps.

Talk about pressure, I demonstrated a 360-degree overhead gliding version as part of an FAA safety seminar on landings. Lori MacNichol and I demonstrated several types of landings live to the audience, transmitting what we were doing over the radio. Lori did the "good" landings in her Super Cub. I did the "bad" ones in the Decathlon. Except for my last landing.

Winds were light. DA was over 5,000 feet. See https://www.youtube.com/watch?v=fJiECo6JEpY

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Reply

Brian Lloyd
September 2, 2023 at 11:33 am

Ah, one of my favorites to teach. I point out all the ways we can adjust drag in order to accommodate wind. I point out that a slip in a C172 with full-flaps is OK, even though Cessna "recommends" against it. My understanding is that it is because of buffeting of the horizontal stab and not because there is any sort of problem that would result in loss-of-control or damage to the airplane. Knowing the "why" for any sort of admonition to do or not-do is crucial when deciding what works and what doesn't.

But I like to go much further and point out that the 180 spot landing is just the final component of the "high-key, low-key," power-off/engine-failure arrival. I teach it starting 3nm downwind from the airport and require the pilot to hit the high-key (overhead upwind) and low-key (abeam the touchdown point) points properly so that safe landing is assured. That is the real reason for the 180-power-off maneuver. I also point out that the high-key point is there to help the pilot find the "keyhole" to fly through to hit the low-key point from which the landing is assured.

It is amazing how much you can change the glide with gear, flaps, slips, and the prop control. What often gets people is that they forget that approaching using published glide speed usually results in WAY too much energy and a lot float. Knowing when (and how) to dirty-up the airplane is crucial.

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Reply

Warren Webb Jr
September 2, 2023 at 4:42 pm

What do you think about RETRACTING flaps to any degree? Since this is considered an emergency therefore 'anything goes' maneuver, in Skyhawks, I found that manipulating the flaps to control speed worked EXTREMELY well. In other words, taking your cue to keep things as fundamental as possible, we would use the pitch in either direction to maintain a steady aiming point, and adjust flaps in either direction from about half flaps to maintain desired speed. The flaps actually worked to keep the right balance between thrust (in this case gravity) and drag to maintain the desired speed. The results were incredibly similar to making a perfect power-on approach.

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Reply

David St. George
September 3, 2023 at 8:25 am

I agree this might be an effective tool if used cautiously, but I think most DPEs on an evaluation, you would get push-back related to the stabilized approach concept: "Incremental deflection of flaps on downwind, base leg, and final approach allow smaller adjustments of pitch and power and support a stabilized approach."
Another restriction might be found in the airplane POH which usually prohibits or strongly discourages reducing flap setting once deployed on approach. This would be another good "discussion point" with the DPE.

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Reply

Brian Lloyd
September 3, 2023 at 11:38 am

As long as I am commenting, I would suggest thinking about how this becomes useful in the real world, i.e. setting up for a safe landing after loss of power. The 180 power-off landing is fine but what most everyone seems to miss is how to get to that point abeam the touchdown point with the proper energy state from which this maneuver may be performed safely and properly. Ya gotta start it right! This is why I stress learning high-key/low-key and then performing the maneuver from cruise altitude some number of miles from the airport. Once you can pull the power on your student and they can demonstrate a safe landing at a more distant airport that is within glide range THEN you know you have done your job. The power off 180 is only the very last component of this much larger maneuver.

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