Stan/Eval Newsletter
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Back to Basics - Descent Planning

If you fly your Piper Cub at 500’ (who would want to go higher?), planning your descent is easy. Strap on your oxygen mask, climb up to traffic pattern altitude, and then land. But for most pilots who fly a bit higher, descending can take a little planning. If you are on an IFR flight plan, ATC will probably specify your descent with either an arrival procedure or other instructions. Sometimes, what ATC gives you may not be advisable, so you need to know what is appropriate and request a different approach. If you are VFR, then a descent is pretty much under your control. Here are some factors to keep in mind before you descend.

Don’t hit anything. This may sound obvious but approaching an unfamiliar airport or even a familiar airport at night takes a bit of thought and planning. If you are at 6500’ inbound for an airport at 500’, ten miles away, then a 600’ per nm descent may be the answer but not if there is intervening terrain or towers in the way. So, part of descent planning is to figure out how to descend safely and not just blindly. Folks who regularly fly in the mountains know that not only do you need to worry about obstacles in the path of your descent, but also maneuvering around terrain may also be required to descend efficiently. Even in the flatlands, there are some tall radio towers in the way that one must consider.

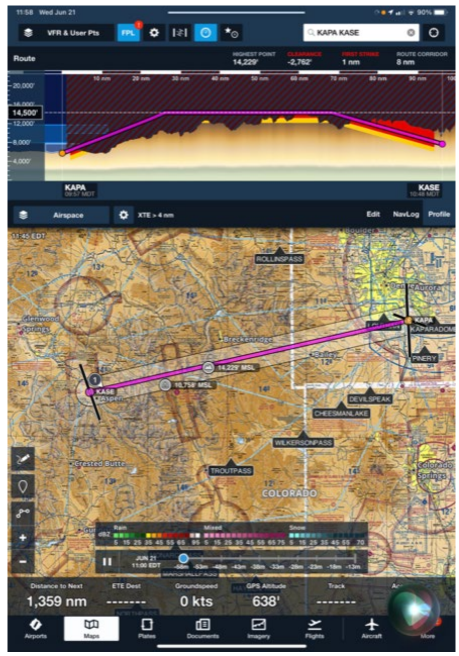
Although less catastrophic than terrain or towers, avoiding airspace you aren’t authorized to fly in is just as important. Class B and Restricted areas come to mind. Again, make sure your descent keeps you in airspace that won’t give you a violation, or worse still, a close encounter of the worst kind.

Begin your descent at an appropriate distance away: Generally, we don’t want to stay at cruising altitude, fly to the airport, and then spiral down (although in some cases that may be the best option). We should normally start our descent at a point that gives us a reasonable rate of descent. In your B777 at FL390, 100 to 150 miles out is a good guess. For a Cessna 182, something on the order of 500’ per minute gives a good descent rate but there is a lot of flexibility here. Avoid any descent rate greater than 1000’ per minute. Doing that near the ground is just asking for trouble and doing that at higher altitudes may make for an uncomfortable ear popping descent. A good rule of thumb is the rule of three (fast airplanes may use the rule of 4 – an equally complex rule). It’s easy to remember and works well assuming terrain is not an issue. The rule is to start your descent three miles out for every thousand feet of altitude. For example, if you are descending from 8500’ into an airport with a pattern altitude of 1500’ you need to lose 7,000’. Using advanced math (3 X 7 = 21) gives about 21 miles out we need to start descending. For our CAP aircraft, using 500’ per minute works fine. You just don’t apply the rule at the beginning. Periodically check using your current altitude to see if you need to increase or decrease your rate of descent as the wind will be a factor. You also need to consider if you want to be at traffic pattern altitude a mile or so before you get to the airport (or you may want to overfly the airport for a look see at say 2,000 feet).

For the advanced student, descending 1,000’ feet every three miles is (again using advanced math) about 333 feet per NM. If you are descending at a 90-knot groundspeed that’s about 500 fpm. At a 120-knot groundspeed, it’s about 670 fpm. Using the equally complex rule of 4 gives a descent rate of 250 feet per NM. At 90 knot groundspeed that’s 375 fpm and at 120 knots 500 fpm. Another way is to use the following formulas to determine how many miles out to start a 500-fpm descent:

- At 60 kts ground speed, 2 times the thousands of feet you need to lose (rule of 2)
- At 90 kts ground speed, 3 times the thousands of feet you need to lose (rule of 3)
- At 120 kts ground speed, 4 times the thousands of feet you need to lose (rule of 4)
- At 180 kts ground speed, 6 times the thousands of feet you need to lose (rule of 6)

For example, if you need to lose 5000 feet at 500 fpm to reach pattern altitude at 120 kts ground speed: 4 times 5 (5000 feet to lose) = 20 nm



Plan a descent route. When you begin your descent, making a beeline for the airport may not be the best plan. We already noted that we don't want to hit anything on the way so consider terrain and obstacles in approaching the airport. Flying into New Market (8W2) for example will take some maneuvering to avoid the hills to the northwest of the airport. We also want to consider where we want to be as we approach the airport. Where to end our approach may depend on which runway is in use, what pattern is being flown, noise avoidance and other considerations.

Use your GPS. Our G1000 and GNS400 have descent planning tools available. Using the "Direct To" function on the G1000 you can generate a glide slope from your current position to any point you want. This can be very handy but beware that it doesn't consider terrain or other considerations. It's just a "direct to" with a glide slope.

Use your flight planning tools: Descent planning can be done with many flight planners like Foreflight, and others. Providing a vertical view makes descent planning a bit easier.

Teaching the ACS for Landing (LtCol J. Lee, MAR)
In a previous article we reviewed the ACS criteria for normal takeoffs. For this article, we'll review the Normal Landing and what the Airman Certifications Standards (ACS) says about the skills required at the Private Pilot Level.

PA.IV.B.S1 Complete the appropriate checklist. For the initial landing, I prefer that this be accomplished before the downwind. The ACS and CAP standards recognize that a flow checklist may be more appropriate, rather than reading a checklist which puts one's head down when one should really be looking outside. If one is performing pattern work, the flow would certainly be more appropriate. An exception to this would be to use CRM and have your observer or other crew member read out the landing checklist.

PA.IV.B.S2 Make radio calls as appropriate.
Refer to the Aeronautical Information Manual (AIM - Section 4) for details.

PA.IV.B.S3 Ensure the airplane is aligned with the correct/assigned runway or landing surface. There are variations to the self-announced position calls at a non-towered airfield. Some claim that announcing the transition point on the legs is more descriptive, e.g., "Jones Traffic, N1234 turning left crosswind to left downwind RWY20, Jones". I agree, except that it has a lot of words…. Personally, I just mention the leg of the pattern. Also notice the syntax, the transmission ends with just the airport name, not "Jones Traffic" – just reduces by one syllable.
One big Verboten: unless directed by ATC or an actual emergency, never execute a 360 in the pattern.

The AIM and AC 90-66b are great resources for non-towered airfields.

PA.IV.B.S4 Scan runway or landing surface and the adjoining area for traffic and obstructions. This dovetails into risk management. Certainly, you would want to know if anyone is holding short or doing the dreaded Line Up and Wait (LUAW). As an aside, never line up and wait at a non-towered airport. Don't forget to be on the lookout for helicopters or gliders since they will fly the pattern as not to interfere with fixed-wing operations.

PA.IV.B.S5 Select and aim for a suitable touchdown point considering the wind, landing surface, and obstructions. During an evaluation, identify this point while abeam on downwind.

PA.IV.B.S6 Establish the recommended approach and landing configuration and airspeed and adjust pitch attitude and power as required to maintain a stabilized approach. A rule-of-thumb for a proper descent rate is: 5 times your ground speed, in feet per minute. For example, during your descent, glance at your G1000's Ground Speed indication. If it's reading 80 KIAS, multiply by 5 and that equals 400FPM. 400FPM along with the following (S7) should give you a descent rate that will minimize the chances of becoming unstable while descending at a reasonable rate. And, if available, follow the VASI or PAPI's.

(Ed note: Following the VASI with its 3-degree glideslope works well on an instrument approach or if you are flying your Learjet. Most CFIs teach a steeper glideslope in a small GA aircraft, especially those that have experienced an engine failure or fly tight patterns. It just works better, and it works better if your engine fails. Whether you follow the VASI or not, always use it as a reference especially at night.)

PA.IV.B.S7 Maintain manufacturer's published approach airspeed or in its absence not more than 1.3 VSO, +10/-5 knots with gust factor applied. AC 91-79A, "Mitigating the Risks of a Runway Overrun Upon Landing", discusses the variables associated with landings. As a reminder, Vso is at Max Gross Weight and Forward CG. I fly what the POH has for a normal procedure (70-80 KIAS flaps up, 60-70 KIAS flaps full). Bear in mind that your stall speed increases significantly depending on your bank angle and flap setting. Furthermore, what the POH cannot quantify is the effect of what a sudden control input has on increasing wing loading. So, try to make smooth control inputs.

PA.IV.B.S8 Maintain directional control and appropriate crosswind correction throughout the approach and landing. Most people use the crab and sideslip method. The area most of us could improve is the *transition* from the crab to the sideslip. Smooth control inputs will also make the round-out and flare easier to perform. "Smooth" is a subjective quality and I can't give a specific metric by which to define it. I would suggest that a "smooth" input will not require another corrective control input to make the plane behave in a manner you originally intended. Similarly, a forward slip's transition to the sideslip will be easier with a concerted effort to make smooth control inputs.

PA.IV.B.S9 Make smooth, timely, and correct control application during round out and touchdown. As mentioned in S8, try to make smooth control inputs. Once the round-out has been initiated, the yoke should act as a ratchet that can only move aft – never forward. If a forward movement is required (post round-out) you have probably flared too high.

PA.IV.B.S10 Touch down at a proper pitch attitude, within 400 feet beyond or on the specified point, with no side drift, and with the airplane's longitudinal axis aligned with and over the runway center/landing path. Here are the elements in detail.

1. "Proper Pitch Attitude": At the instantaneous moment of touchdown (or for that matter on takeoff), while seated comfortably, the top of the cowl should be touching if not slightly above the end of the runway. To describe "slightly above", extend your hand to the top of the glareshield and add a finger width of positive pitch. There is some variability with using a finger width technique, since everyone sits at a different fore/aft, up/down position. However, I'll go out on a limb and claim that is closer to a finger (or maybe two) widths, rather than four-five finger widths….
2. Failing to adhere to "within 400 feet":
    a. Note that 400 feet is ***30% longer than a football field!*** It also helps to know the dimensions of the runway markings. For example, the centerline stripes are (see Chart Supplement for details for any particular runway) 120 feet long with 80 feet gaps. The aiming points are 150 x 20 feet. (Be aware that they may be shortened to 100 feet, if the runway is shorter than 4,200 feet).
    b. Almost invariably, this is the result of too much airspeed. While the difference between a flare speed of 60 to 70 KIAS is only 15%, the difference in kinetic energy is 36% - that means you must dissipate a lot more energy and distance before the airplane will settle onto the runway.
3. "No side drift" or Landing with the fuselage at an angle to the centerline: This places a side load to the landing gear and if control inputs do not keep the upwind wing down, it could result in the airplane rotating about the downwind wheel. Should skipping occur, and if left uncorrected, it could lead to the downwind wingtip contacting the ground.
4. Failing to keep on "center/landing path". I translate it to meaning the runway centerline remains between the main wheels until ready to taxi off the runway. (BTW – In a Skylane the distance between the mainwheels is 9 feet.) I want to see the pilot maintain the centerline within the two main wheels. If they are briefly touching the centerline with the mainwheel but correcting, I feel that the pilot is aware of their location and making the appropriate control input.
5. Keep the yoke back after touchdown to reduce the weight on the nose gear, especially in our C182/206 aircraft. Letting go of the yoke on touchdown puts unnecessary stress on the nose gear.

PA.IV.B.S11 Execute a timely go-around if the approach cannot be made within the tolerances specified above or for any other condition that may result in an unsafe approach or landing. The Go-around is a separate task within the ACS and a topic for another article. (Refer to CAPS 73-1 for details on Go-arounds and Coupled Go-arounds.) Once the decision is made, don't rush – remember: Aviate, Navigate, Communicate. Don't get tricked by the term "timely" - there are no time-based conditions for the execution of the element of a Go-around. Pay attention to the scenario that calls for a Go-around. For instance, how would you execute a Go-around if an airplane started their takeoff roll while you were on short final as opposed to deer on the runway?

PA.IV.B.S12 Utilize runway incursion avoidance procedures. The term "incursion" implies when you are entering the runway. I commonly observe this while I'm holding short and observe an airplane is exiting the runway environment. For example, a pilot will self-announce "Walker Traffic, N1234 clear Runway 33, Taxiway Bravo, Walker". Unfortunately, the tail section of the aircraft is still not completely clear of the hold-short line. Therefore, the airplane is still within the runway environment and another airplane entering the runway risks an incursion. On the other hand, while holding short of the runway prior to takeoff, I notice pilots' taxi very close to the hold-short line. Unless tower-directed or for some other operational reason, I advise pilots to stop in such a manner as to be able to view the hold-short line end-to-end while comfortably seated.

All CAP instructors should be teaching to the appropriate ACS. I hope these observations help!

Back to Basics – Spin Training

In 1949, the FAA dropped the requirement for spin training from the Private Pilot syllabus as there were too many accidents involved with the training. Instead, emphasis was placed on stall and spin awareness. Ever since that decision, there has been an ongoing controversy. Some believe very strongly that you can't be a competent pilot without having spun and recovered. Others believe the FAA made the correct decision. The FAA continues to require spin training for all SEL CFI applicants.

Despite that controversy, no one argues that upset training (which includes spin training) is a good thing for pilot proficiency. Many flight schools offer such training and do it very safely. This training provides the pilot with the skills and confidence to recover from an upset and goes a long way in removing the fear of an upset. Many pilots have never been upside down, which is a problem as it can be very disorienting when first experienced. Finding yourself in an upset is a poor time to find out you don't know which way is up. It also takes some skill to recover properly without over stressing the airframe. The following is an extract from the NTSB on an upset in IMC that caused structural damage.

"On June 15, 2011, about 1405 eastern daylight time, a Beech A100, N15L, operated by Dynamic Avlease Inc., was substantially damaged when it experienced an in-flight upset, while in cruise flight near Gray,

Tennessee. The two certificated commercial pilots were not injured. Instrument meteorological conditions (IMC) prevailed, and an instrument flight rules flight plan had been filed for the flight that departed Bridgewater Air Park (VBW), Bridgewater, Virginia, destined for Mid-Continent Airport (ICT), Wichita, Kansas. The positioning flight was conducted under the provisions of 14 Code of Federal Regulations Part 91.

According to initial information obtained from the flight crew and the Federal Aviation Administration (FAA), the airplane was flying in smooth IMC conditions at Flight Level 200 (20,000 feet msl), with an area of "moderate to heavy to extreme" precipitation located about 30 miles to the northwest. As the airplane approached 20 miles from the weather, it began to experience moderate turbulence and "several seconds of rime ice" on the windscreen. The pilot flying deviated course 40-degrees to the south. Turbulence increased further for about 10 seconds, and the airplane then entered an uncommanded left roll and dive. The autopilot disengaged and the pilot's electrically driven attitude indicator tumbled. The flight crew reduced the engine power levers to idle and were able to recover utilizing the copilot's vacuum driven attitude indicator. The airplane was returned to straight and level flight at an altitude of 8,000 feet; however, "flight control instability" persisted. The flight crew subsequently diverted to Tri-Cities Regional Airport (TRI), Blountville, Tennessee, and landed without further incident.

Subsequent examination of the airplane by an FAA inspector revealed that the outboard one-third of the left elevator separated in flight, and the outboard right elevator was deformed downward. In addition, the horizontal stabilizer bulkhead frame was fractured, and the aft portion of the airframe sustained several areas of deformation."

Spin or upset training is not a onetime training event. It does need to be repeated periodically. **All CAP aircraft are placarded against spins,** but this doesn't mean that you might not find yourself in an upset situation. Make sure you have the skills to recover!

The proper spin recovery for most aircraft (including VAWG Cessna aircraft) can be summarized by the acronym PARE (but read the POH as techniques vary):

- **P**ower to idle. This is critical as power will only make the spin worse and more difficult to recover from.
- **A**ilerons and elevators to neutral – don't keep inducing a stall or a spin.
- **R**udder opposite to the spin – pilots can find it difficult to determine which way they are spinning due to disorientation. Your turn/bank indicator will show the direction of spin (ignore the ball – it's useless in a spin). It can also take a few seconds to stop the rotation in a well-developed spin so be patient unless of course the ground is approaching quickly in which case jump (you have your chute on, right?).
- **E**levator – As the spin stops, center the rudder, and use forward elevator to break the stall. Be careful not to overstress the aircraft as you will be nose down and gain airspeed quickly. For some aircraft, opposite rudder and forward stick are applied simultaneously. On others, forward elevator is applied only after rotation stops.

The aerodynamics of a spin can be quite complicated (Bill Kershner's books have a good explanation), but simplistically, an aircraft in a spin is both stalled and rotating. Because it's in a stall, the aircraft is flying at a slow speed. The ASI will show something close to the stall speed.

Unlike a spiral, airspeed will not increase (although it may vary slightly). Typically, a small GA piston aircraft will lose about 500 feet per rotation although that varies by aircraft type.

It's important to differentiate between a spin and a spiral dive. In a spiral dive, the aircraft corkscrews down with airspeed building quickly. A spiral dive is very dangerous as the airspeed will reach Vne very quickly causing airframe damage and is impossible to recover from if it continues. If you think you are in a spin, but your airspeed is increasing, you are in a spiral dive. Pull the throttle, level the wings, and pull back gently on the yoke to reduce airspeed and return to level flight. The key is to not pull too many G's in the recovery. If you let it get too far, that becomes impossible. Spiral dives are often the result of spatial disorientation in IMC.

A flat spin implies rotation with little or no forward motion. When this happens, the airflow across the rudder is insufficient to stop the rotation. This can happen with an airplane that has exceeded its rearward center of gravity limits and makes recovery difficult or impossible. The following NTSB (**LAX08LA191)** report demonstrates some poor pilot judgment in a C172 resulting in three deaths.

"*Witnesses flying in a second airplane reported that the two airplanes left their home airport earlier in the day. They flew to another local area airport for a snack where they discussed the return flight (the accident flight). The accident pilot told his peers that he was going to do a spin on the way back to their home airport. He said that he had done spins before with a flight instructor and a passenger in the back. The two airplanes departed the local airport and were enroute back to the home airport when the accident airplane radioed the other airplane indicating that he was setting up for the stall/spin maneuver. The pilots in the other airplane watched as the accident airplane began a climb from 5,500 feet to 7,500 feet and commenced with the stall/spin. After one full turn, the airplane returned to normal flight. The accident pilot radioed the other pilots and told them he was going to do another stall/spin and was going to let it spin a "little more before he starts[ed] the recovery." The witnesses observed the accident airplane set up for another spin, enter the spin, and watched as the airplane continued to spin until it crashed into the ocean. According to Cessna, intentional spins are prohibited when the rear seat(s) are occupied. Three people were on board the accident airplane. The airplane and two of its occupants were not located despite efforts by the United States Coast Guard and a private diving company.*

The National Transportation Safety Board determines the probable cause(s) of this accident as follows: Failure of the pilot to regain airplane control during an intentional stall/spin maneuver."

To prevent getting into unanticipated spins, instructors should emphasize spin avoidance. Because an aircraft needs to be in a stall before a spin can develop, it's important to teach stall awareness. Instructors should also exercise caution in teaching power on stalls. A power-on stall can develop into a spin if not properly executed. An airplane intentionally stalled at a high-power setting (as we do on every Form 5 flight) can spin because of the torque of the engine inducing rotation. It is important that the ball be kept centered during these maneuvers. Should any rotation begin, stop the rotation immediately by applying opposite rudder, pulling the power back, or both.

Not only will keeping the ball centered avoid spins, it's also the only way to fly (other than intentional slips or cross wind landings). Instructors should be alert to the "feet on the floor" style of flying and teach stepping on the ball.

The History of Drones (Flying Magazine)
As CAP finds more and more uses for drones, it's interesting to know that drones have been around for a long time. This article from Flying provides a historical perspective on drones. Click here.

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