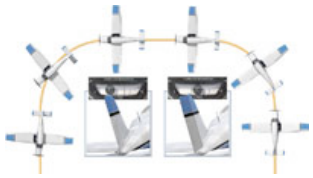
April 2005

Features

The dirty dozen

12 concepts pilots frequently forget

Why does a student pilot who was taught from the first lesson to always use rudder with the aileron mature into a pilot who seemingly has no feet? Why do students have difficulty retaining and applying basic concepts after they become certificated pilots? Did something go awry in the learning process?



Adverse yaw

It's tempting to say that a student of any subject doesn't know the basics because the instructor didn't teach them effectively. Or, more likely, he didn't continue to emphasis the basics. That may be true to a point, but it's not the entire story. It's a little too trite, a little too convenient. And it tries to place all the blame on one side of the fence, when the truth is that blame has to be shared.

None of the concepts mentioned here are closely held secrets. Every single flight training manual goes into excruciating detail on each. The knowledge is there for all to read, so there is zero excuse when an instructor explains one of these concepts and gets a blank look from the student in return -- he's not saying anything that isn't in the books. Of course, the student has to read those books to know that.

You stand a much better chance of understanding a concept if you come prepared. Your time in the cockpit is better invested -- and your instructor's life is much easier -- if you are already familiar with what the instructor is about to say.

We could discuss an infinite number of concepts, but these are the ones we feel are most commonly misunderstood, most often misapplied, or most frequently missing from the lesson plan.

1. Adverse yaw

Adverse yaw may be the most universally misunderstood -- and probably the most forgotten -- aviation concept. It's like this: The outboard wing in a turn will be slowed by excess drag, causing the nose of the airplane to move (*yaw*) opposite, or *adverse* to, the direction of the turn.

The lift on the two wings isn't equal because the down aileron increases lift and the up aileron decreases it. With increased lift comes increased drag, which pulls the wing back and requires the use of rudder into the turn to keep the nose tracking in the right direction. In other words, *every single time an aileron is deflected in normal flight, rudder has to accompany it.* Like we said -- basic. For a more detailed explanation of adverse yaw, see "Camber is the Key," November 2004 *AOPA Flight Training*.

2. Applied aerodynamics

Any good driver understands how his car interfaces with the road through traction, and this knowledge helps him to control it in skids or on slick roads under varying conditions.

The same thing applies to basic aerodynamics. Unfortunately, while many students can parrot the definitions, they don't really know how it all works. It's critical that you work to develop an intuitive understanding of how the airplane interfaces with the air. This includes things like the lift/drag relationship, the effect of angle of attack, the effect of speed and G forces, the relationship between airspeed and power, and other basics.

When strapped in the airplane you need to understand how to apply what you were taught, and what you can do to affect it. Only then will you truly be in control of the airplane.

3. Airplane awareness

It's surprising how many pilots habitually fly along with one wing slightly low because they just aren't aware of the airplane. These pilots don't realize that it's not necessary to look at the airspeed or the nose attitude to know that they are speeding up, because the air noise is getting louder. Or, they don't have to look at the skid ball to know they aren't in coordinated flight, because their butt is sliding across the seat.

The airplane talks to you in many languages that enter through your various senses, including sight, sound, and feel.

4. Planning ahead

Planning ahead and situational awareness go together. Planning ahead, however, carries an additional ingredient in that you project what will happen next and not only lay out the course in your mind -- whether it's downwind or a cross-country leg -- but also develop an outline of what actions will have to be taken and when. If you don't, you'll be constantly dealing with crisis management and stand a very high risk of falling behind the airplane.

5. Pilotage and dead reckoning

With the fantastic navigation aids available, it's tempting to just push the "To" button on a GPS receiver and launch. As a result, many pilots have forgotten how to plot a course and fly it.

Remember, compasses and sectional charts never need batteries or electrical systems, and they seldom fail. So, at least as a backup to the GPS, keep a thumb on the line you drew on the chart, and keep your compass heading in mind. (You *do* have a current chart on board, don't you?) If the fancy stuff decides to take an unscheduled vacation, you'll still know where you are.

6. Traffic control

Dealing with other air traffic requires you to plan ahead and develop situational awareness. Decide that you're going to control your own destiny and not let other people fly your airplane for you.

This is especially true in the airport traffic pattern. Forget the concept of right of way and home in on the concept of safety. In other words, even if you have the right of way, don't hesitate to give way for another aircraft -- remember that his situational awareness skills may be lacking, and he has no idea that you're there. Be the pilot who always solves potential traffic problems, by keeping track of the traffic and altering your path to eliminate problems.

7. Power and prop effects

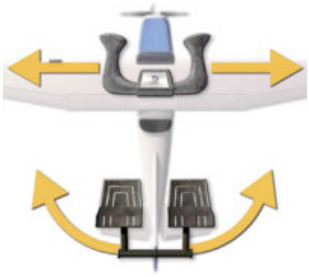
The propeller is essentially a gigantic gyroscope combined with a helicopter rotor. Because of that, certain phenomena are to be expected from it. These include, but are not limited to:

- *Torque* -- The prop is turning one way but the engine is trying to turn in the other direction -- and it wants to take the airplane with it.
- *Gyroscopic precession* -- When you try to change the propeller disk's orientation, say by raising the tail on a taildragger on takeoff, it causes a force to act at right angles to the axis of rotation. On a U.S.-manufactured engine that turns clockwise (as seen from the cockpit), this results in a left-turning tendency.
- *P-factor* -- The blades don't pull evenly because of the interaction between forward motion and the down-moving blade, which causes the nose to yaw.
- *Spiraling slipstream* -- The air coming off the propeller isn't going straight back down the fuselage but in a spiral pattern that causes it to hit the tail in an asymmetric fashion that can cause the airplane to yaw.

All of these effects are counteracted by rudder input and each phase of flight that includes any of the above (changing power being the biggest culprit) requires varying amounts of rudder in varying directions.

Power and prop effects

Attitude and airspeed control



Crosswind basics

Torque, depicted by the blue arrow (top) causes a left-turning tendency that opposes the propeller's rotation (yellow arrow). The airplane's nose attitude tells you what the airspeed and artificial horizon are *about* to do (bottom). There are two crosswind basics -- cancel drift with ailerons and maintain runway alignment with rudder (center).

8. Attitude and airspeed control

Students generally understand early in their training the concept of controlling the airspeed by moving the nose up or down. After they get their private pilot certificate, however, too many pilots forget what a great source of information the nose attitude can be. They depend on their instruments rather than using the nose as a primary indicator of what the airplane is doing.

The nose tells you exactly what the airspeed and artificial horizon are *about* to do. Not the other way around. The instruments *always* lag behind the nose. If you develop a clear understanding of what nose attitudes represent and predict, and you learn to control the nose, your instrument readings will always be in the ballpark.

This definitely does *not* mean that the airspeed indicator is ignored, because that obviously is not the case. But it *does* mean that instead of chasing the airspeed, you should set a pitch attitude, wait until it stabilizes, then check the airspeed to see how correct the attitude is. If it's wrong, adjust accordingly. The real payoff of actually being able to "see" the nose and control it is that it's extremely unlikely you will let it get either too high or too low, which means the airspeed will always be in a safe range.

9. Situational awareness

Situational awareness -- understanding where your airplane is in relationship to the ground and other traffic -- follows closely behind attitude awareness. Because we don't have curbs to contain our movements, it's difficult for some students to keep track of how they got to any given point in space or determine how to get where they want to go. They fly the airplane as if they are a ship in the middle of the ocean and don't keep references in mind.

It's critical that every pilot develops a habit of creating a mental moving map that tells where they are in reference to important points (runways, checkpoints, etc.) and in relationship to other traffic, as seen through the windshield or relayed by radio communications. Picture yourself moving along a map and put pins in it that say where other airplanes are and how they are going to affect your flight.

10. Anticipating radio communication

Communication with air traffic facilities is intimidating to many students, and they're amazed by the way their instructors handle it so effortlessly.

Besides the obvious factor of experience, the instructor is anticipating what the tower is about to say, and as a result the words make sense before they are even transmitted. Listen closely and notice how a tower always wants certain things from you at certain times (aircraft type, N number, position, and intentions). Controllers will reply to you with directions that vary only within a very narrow range.

After you've listened for awhile, you'll no longer struggle with what to say or to understand what you're being told, because you'll already know what's likely to be said. And, if you don't get it the first time, a simple "say again, please" rectifies that (see "Talk Show," November 2002 *AOPA Flight Training*).

11. Crosswind basics

Crosswinds can haunt pilots of all experience levels, but the reality is that virtually any airplane can handle more wind than you think it will, if you control the wind rather than letting the wind control you. Determine the line you want to fly and be forceful about it. At the same time, *don't over-intellectualize the process*.

The two primary rules are to keep the tail lined up behind the nose with rudder, and kill all the drift with ailerons. You can forget about cross-controlling because it will happen automatically when you follow the two basic rules. Correct or kill the drift with the ailerons and, if that amount of aileron is enough to pull the nose off center (*see adverse yaw*), apply rudder to keep the nose pointed down the runway.

And don't avoid crosswinds. Get out there, with an instructor if necessary, and make up your mind to conquer them. Otherwise, you are going to be constantly worrying about something that doesn't need to be worried about.

12. Precision

When you first start flying all you see is blue sky, brown ground, and the runway. The details aren't noticed. But as you progress, your life will become easier if you introduce precision to your flying, especially inthe pattern.

Precision is based on noticing details such as drift and groundspeed. Fly your downwind in the same place every time. Reduce power the same way, every time. Fly a consistent and exact airspeed as recommended by the pilot's operating handbook and put the airplane down in the first 500 to 800 feet of the runway, regardless of how long it is. Strive to be consistent with your touchdown point. Approximations in speed, altitude, and distance within the pattern are the enemy of precision. Actually, *approximations of any kind, at any time, are the enemy*.

Now that we have developed a list of these favorite foibles, use it as a study guide to stay ahead of your instructor. Think of it as a way of keeping that "what?" look off your face following an explanation. You can also use this as an instructional checklist to make sure all of the high points have been discussed.

Finally, use the list as a "How am I doing?" guide to be trotted out periodically throughout your flying career. You're never too old to go back and verify that you still know what you thought you knew when you were young.

Budd Davisson is an aviation writer/photographer and magazine editor who has written approximately 2,200 articles and has flown more than 300 different types of aircraft. A CFI since 1967, he teaches about 30 hours a month in his Pitts S-2A Special. Visit his Web site.

By Budd Davisson
Illustrations by David Diamond

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