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Slow Steady Sure

Photos by Tom Hoffmann

Avoiding Loss of Control in Maneuvering Flight

Pilot lore is replete with reminders about the importance of airspeed. We hear "speed is life." Instructors chant a "watch your airspeed" mantra. Comedians quip that flying requires only two things: airspeed (there it is again) and money. Airspeed is a frequent topic because sufficient airspeed is essential to generating the lift needed to establish and maintain flight. We also hear about airspeed for tragic reasons: Loss of control in maneuvering flight, the number one cause of fatal general aviation accidents, often results from inattention to airspeed.

Maneuvering flight is one of the four topic areas for the 2nd Annual FAASTeam Safety Standdown. This year's standdown includes an event on April 2 in conjunction with the Sun 'n Fun International Fly-in and Expo, more than 90 events around the country during the month of April, and special material on www.FAASafety.gov starting on April 2. Here are some basic airspeed awareness points as background for Safety Standdown.

Knowledge: Lift, Load, and Speed

When it comes to maneuvering flight, what you don't know *can* hurt. Sound knowledge of basic aerodynamic principles, including a grasp of why airspeed is so important, is an essential foundation for avoiding loss of control in maneuvering flight.

To begin with, maintaining control of an airplane during flight requires maintaining lift. Lift is produced by the dynamic effect of air—in effect, airspeed—acting on the airfoil, or wing. The pilot controls lift by controlling airspeed and the angle of attack (AOA), which is the acute angle formed between the wing's chord line and the relative wind, that is, the direction of the air striking the wing.

The pilot also controls lift by controlling the speed and direction of the relative wind. Lift is proportional to the square of the aircraft's velocity (speed), so doubling the speed will quadruple the lift. Pilots learn that for every AOA there is a corresponding airspeed required to maintain altitude in steady, unaccelerated flight. An airplane flying at a higher airspeed can maintain level flight with a lower AOA, while the same airplane flying at a slower airspeed must have a higher AOA to generate enough lift for level flight. The curriculum for primary flight training includes airspeed change maneuvers designed to demonstrate this relationship.

Student pilots learn that there are limits at both ends of the lift-velocity continuum. At the upper end, the amount of thrust produced at full throttle limits the pilot's ability to increase lift by increasing airspeed. At the lower end, the ability

to increase lift by increasing AOA is limited by the wing's critical angle of attack. As you recall from ground school and from practicing aerodynamic stall entries and recoveries, increasing the AOA increases lift until the wing reaches the maximum (critical) AOA. Increasing AOA beyond this point results in a large loss of lift, an increase in drag, and a wing said to be stalled.

It is crucial to remember that airspeed is not the only consideration in loss of control from an aerodynamic stall. As discussed in the March/April 2010 issue of *FAA Safety Briefing* ("Getting it Right in Maneuvering Flight"), the pilot must also consider the impact of physical weight and aerodynamic weight (load) on the airplane.

This point is especially important for pilots of airplanes with high wing loading, a value derived from dividing the loaded weight of the airplane by the area of the wing. Engineers use wing loading as a measure of an airplane's basic maneuvering performance because the greater the velocity (airspeed), the more lift is generated by each square foot of wing area. A slower airplane with a large wing area (low wing loading) will be able to generate more lift at any given speed. A faster airplane can use high wing loading to generate the same amount of lift with a smaller wing. The trade-off comes in the form of higher take-off and landing speeds and decreased maneuverability, especially at lower airspeeds. Pilots who own or fly some of today's fastest GA aircraft—including experimental and amateur-built models—need to have rock-solid knowledge of these principles.

Skill: Aeronautical Tune-up

Knowledge is the foundation, but skill is the structural scaffolding for safety in maneuvering flight. You may have thought your instructor was cruel when he/she made you practice maneuvering at minimum controllable airspeed (slow flight), followed by aerodynamic stall entries and recoveries from both takeoff (power on) and landing (power off) configurations. However, your instructor was merely trying to develop and strengthen your ability to maintain control in all phases of flight.

No matter how much you study maneuvering flight and airspeed control, the only way to develop the actual skill is to get into the airplane and practice to proficiency. To start your maneuvering flight skill tune-up, grab or download a copy of the FAA's *Airplane Flying Handbook* (FAA-H-8083-3A) and review Chapter 4, "Slow Flight, Stalls, and Spins."

If you do not feel proficient enough to practice on your own, hire a flight instructor to help you remove the rust. Ask to start with a review of the airspeed changes exercise from the private pilot training syllabus. A few minutes of practice will strengthen your airspeed perceptions, insights, and flying skills. Your maneuvering skill tune-up should also include practice in recovering from unusual attitudes, which can easily develop from loss of control.

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Attitude: Focus, Focus, Focus

Now, more than ever, many of us operate in multi-tasking mode. Multi-tasking is an inescapable part of life and pervades aviation as well. It is both necessary and appropriate in some phases of

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flight, but dangerous in others. Maneuvering flight, especially operations that require flight in the lower range of the airspeed indicator, is one phase of flight that deserves your full attention. A few tips:

Priorities. Remember that the iron law of aeronautical priorities is aviate, navigate, communicate. The slower you go, the more you should narrow your focus to priority number one: Flying the airplane.

Distractions. When engaged in maneuvering flight, especially the takeoff–initial climb and approach–descent–landing phases, do everything you can to minimize distractions from every source. If you have passengers aboard, explain sterile cockpit practices during the preflight briefing and again when you conduct the pre-landing briefing. Even if you are alone, it is a good idea to self-brief. Verbally reviewing sterile cockpit procedures can help you establish the focused, no-nonsense mindset you need for critical phases of flight.

Sufficient airspeed is essential to generating the lift needed to establish and maintain flight.

Briefings & Checklists. Be meticulous in reviewing critical requirements, procedures, and numbers before you need to use them. Maintain the habit of self-briefings or, if you regularly fly with another pilot or a savvy non-pilot, develop standard operating procedures for conducting operational briefings and running checklists.

And, always watch your airspeed!

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For More Information

Airplane Flying Handbook (FAA-H-8083-3A)
www.faa.gov/library/manuals/aircraft/airplane_handbook/

"Maneuvering: Approach and Landing" course on FAASafety.gov (requires FAASafety.gov account login and password)
https://www.faasafety.gov/gslac/ALC/course_content.aspx?pf=1&preview=true&cID=34

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