



Angle of Attack Indicators

End the Guessing Game

by Crista V. Worthy

We know a stall occurs when a wing exceeds its critical angle of attack, and this can happen at any airspeed or attitude. The key during takeoff, landing, and other maneuvers is to know how much remaining lift is available to keep the airfoil flying. If your brain is as quick as a computer, you could calculate when your airplane will stall. It's a function of your airplane's exact weight at that moment, how many Gs you are subjecting the airplane to based on your bank angle, and so forth. I don't do that, nor do most of us, so we ballpark safe indicated airspeeds.

But if you're trying to get into a tight airstrip, you can't just add a few extra knots as a safety margin or you may overrun the end. You have to shrink your margins, and not knowing exactly when the plane will stop flying is what greatly increases the pucker factor at short airstrips. Pilot Getaways editor, John Kounis, happens to be a math whiz; before he got an angle of attack (AOA) indicator, he would always calculate his exact minimum indicated airspeed for landings and other maneuvers based on his operating weight. I know this because I've

flown with him. If I came in at exactly the indicated airspeed he told me to, the plane would set down fine. If I came in faster, we would float.

As the GA accident record shows, too many pilots run off the ends of runways or turn too steeply at too low an airspeed, causing a stall, spin, and crash. An AOA indicator ends this guessing game, which means it can save lives. The FAA recognized this fact last February by greatly simplifying design approval requirements for AOA devices. Now, AOA indicators offer the greatest safety enhancement for the money since seat belts, and most systems are priced under \$2,000.

In many AOA systems, a lift reserve computer uses the difference in pressure measured between two ports on a calibrated pitot probe, usually mounted on an existing inspection plate on the underside of the wing outside the propeller arc. Proper calibration is critical though not difficult, plus, the instrument will only be 100 percent accurate in exactly the conditions during calibration. Heated probes are recommended for those who fly IFR. The differential pressure data collected by the probe is serialized

within an interface module and then sent to the AOA indicator, which is typically mounted on the glareshield within the pilot's field of vision. An AOA indicator reacts more quickly than your stall warning or airspeed indicator and is more reliable; AIs often become inaccurate at low airspeeds or unusual attitudes, precisely when their information is most critical. Manufacturers have jumped into the AOA arena with both feet and pilots can now choose from a variety of devices. Their displays vary, but they all indicate when you're nearing the stall realm. Once you build confidence in your device, you may find yourself able to safely fly into airstrips you once considered too short, and you'll have a better understanding of what is happening during turns. John Kounis told me it took him a year to start trusting his

Alpha Systems AOA indicator as the primary reference for pitch during a short-field approach instead of airspeed. **Alpha Systems** is the current leader in terms of available display options. Green lights are shown during normal cruise. On approach, a blue light indicates the optimum alpha angle (best angle of attack for a short-field approach). Yellow means

your AOA is lower than optimum and you should raise the nose. If your AOA is too high, you'll see red lights that warn you to lower the nose. These color-coded lights allow the pilot to take the airplane closer to the stall without exceeding the critical AOA. At press time, they offer at least six different displays, with colored lights shown in vertical, horizontal, or round configurations. They also offer a new Heads-Up Display (HUD) adapter. Many of the indicators have up to 16 different LED brightness levels. There's also an audio alert output with a mute switch, 763- 506-9990, www.AlphaSystemsAOA.com. **Alpha Systems** also makes the KLR10 for Bendix King. The KLR10 has the same color scheme and similar options, 855-250-7027, www.BendixKing.com.

Garmin's AOA uses what's called a normalized system. Compared to lift reserve systems described above, Garmin claims it measures AOA slightly more accurately although its multiple components will probably make installation more expensive (ask your mechanic). The components include the GI260 indicator, which, like those above, is easy to read: four green bars and a green dot mean you're on the correct

AOA, increasing yellow bars, chevrons, and then red mean you are approaching a stall. It also provides aural warnings. The other components are a GAP26 probe and GSU25 air/data computer. Pitot and AOA air pressure are sent from the probe to the computer through pneumatic plumbing. The computer takes the probe measurement and an independent static source measurement, corrects for current flap setting, G-load, and atmospheric conditions, computes proper AOA, and sends it to the indicator through an RS-232 serial data connection. The display can also be shown on a G3X Touch integrated avionics suite, if you have one, but that would not be on the glareshield in your field of view on approach, 913-397-8200 or 800-800-1020, www.Garmin.com. Do you have an experimental aircraft? Advanced Flight Systems' Pro and Sport series models operate on differential pressure gathered from two small holes in the wing. A flap sensor lets you calibrate it for both clean and approach flaps; it then corrects automatically. A built-in gear warning is included. Owners of certified aircraft might—but probably won't—be able to get FAA field approval though, 503-263-0037, www.Advanced-Flight-

[Systems.com](http://www.SafeFlight.com). Meanwhile, Safe Flight, which invented stall warning lift detectors nearly 70 years ago, offers the SCX, mounted on the wing's leading edge. The company contends it has the most accurate device on the market, since the leading edge is the only location to accurately measure AOA in all conditions. That location has also so far precluded FAA approval, as installation requires cutting the wing, but the company now expects certification in early 2015, 914-220-1125, www.SafeFlight.com.