

Flight by Alpha Angle: Beats an ASI Hands Down

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By Jim Cavanagh

Flying angle of attack is safer and more precise than airspeed reference. These inexpensive gadgets bring that capability to the light aircraft GA cockpit.

At the dawn of the last century, it didn't take the Wright brothers long to figure out that wings stall at a measurable angle of attack. Student pilots are taught this concept, then promptly trained to forget about it and use airspeed to detect an impending stall. That's because light aircraft have airspeed indicators, but they don't have angle of attack

indicators. Yet there's no reason they shouldn't have these gadgets and, in fact, there are four companies hawking such products. The argument for AoA indicators is convincing. By learning to fly angle of attack rather than airspeed, an airplane can be flown more precisely at slow airspeeds, improving short field [IMGCAP(1)]performance and reducing stall/spin surprises.



Lift Reserve

Angle of attack indicators are old hat for military and commercial jet aircraft, but their history for small aircraft is recent. The product that first gained notice in this arena was conceived by Morgan G. Huntington and marketed in the 1980s. Huntington developed a gauge that used differential air pressure to determine when an aircraft was approaching, reaching or passing the stall angle of attack. This device was originally called the Huntington Airspeed Director, but was later rechristened the Lift Reserve Indicator. Huntington's work and his product capitalized on the principle that regardless of weight, temperature or altitude, stall angle of attack is constant. If you have a means of flying at that angle, you can extract peak low-speed performance and land on a dime or climb at best efficiency.

An LRI is technically not an AOA indicator. Rather it's a purely mechanical pitot-type device that uses subtle differential pressure measurements to surmise angle of attack. More sophisticated lift reserve instruments used a computer module into which the pitot tubing is routed and the pressures are transposed into electronic signals for LED readouts, but the principle is the same. True AoA devices—which are also available for light aircraft—use a vane sensor to directly measure AoA and are both more complicated and expensive than LRIs. If anything has kept the LRI from becoming more popular, it's probably a misunderstanding of what it does and the unconventional size of the indicators. The original Huntington LRI was a hulking 2 1/4-inch instrument designed to be mounted on the glareshield.

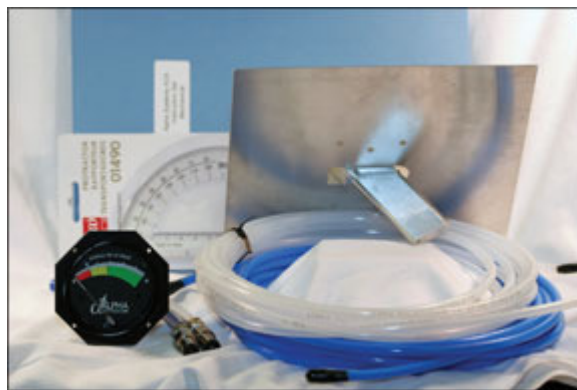
But despite the tiny niche these products occupy, the display technology has improved recently. One-entry level LRI still uses the 2 1/4-inch round instrument, but other providers have developed gauges to fit both large and small panel holes and LED or LCD indicators that take up little panel space. Here's a rundown on the four players in the LRI/AoA field. Bear in mind that LRIs are not certificated and will require an FAA Form 337 to install, although one company is seeking certification.

InAir Instruments

InAir Instruments, LLC, of Westerville, Ohio, seems to be the go-getter in the LRI business. You can tell from talking to InAir's owner, Al Mojzisk, that he wants you as a customer. Mojzisk was partnered for a while with Jim Huntington, son of the [IMGCAP(2)]LRI's conceptualist, Morgan Huntington, but they've since parted. The InAir LRI costs \$450 and uses a probe mounted under the wing to obtain the air pressures. InAir can provide an analog indicator for glareshield or panel mount and an optional heated probe for \$100 additional. Although improved and cosmetically different, the InAir is the same unit Aviation Consumer installed in its Mooney 201 nearly 20 years ago. The kit has surprisingly few parts, but is complete and requires several hours to install. InAir has an extensive Web site, www.liftreserve.com, that discusses LRI theory and history and it publishes a number of endorsements and anecdotes from users.

Alpha Systems AOA

The **Alpha Systems AoA** was a virtual duplicate of the InAir Instruments LRI system until the gauges were revamped by Mark Korin, of DepotStar, Inc., based in Ramsey, Minnesota. Due to confusion regarding the LRI name as well as buyer perception of what it did, DepotStar decided to adopt **Alpha Systems** in deference to the military standard of alpha angle as a primary approach reference. Korin is an inventor by trade and works with a number of companies in developing instrumentation and manufacturing gear. A pilot, he has thought through all of the problems and anomalies of the original Huntington product and was brought into the business by then-partners Jim Huntington and Bill Geipel to design a graphics display for the unit. (Jim Huntington later partnered with Al Mojzisek, of InAir, and Geipel partnered with Korin, but both of these partnerships have since dissolved.)



Alpha Systems offers a bar graph display that initially set it apart from the InAir unit, but it recently developed high-quality, glass-faced gauges that fit into standard cockpit holes. Alpha also developed a carbon-fiber panel mount gauge [IMGCAP(3)] that's significantly lighter than the old gauges. Their graphics on the analog instruments are easy to read and decipher.

Alpha System's basic product price is \$550, while the electrical graphic system costs \$895. For another \$100, you can buy a heated probe. (See www.alphasystemsaoa.com for more.)

Alpha calibrates their system by the push of a button—a benefit of a system using a microprocessor—and rather than at stall, it prefers that pilots use minimum controllable attitude for calibration. The basic system is totally independent of any aircraft system and Korin has letters from the FAA allowing installation of the non-heated probe kit on any aircraft, requiring merely a logbook entry and A&P signoff.

EM Aviation

Elbie Mendenhall is an airline captain who approaches LRI/AoA from a different angle, pardon the pun. His products obtain AoA information mechanically, just like airliners do, by using free swiveling vane mounted on about any vertical surface outside of the prop wash. This makes it ideal for twins or pusher aircraft, but it also makes it challenging to install out of the prop wash on tractor-type airplanes. EM offers two models, the [IMGCAP(4)] Rite Angle Buddy and the Companion. The entry-level Buddy comes without the flap indexing function and costs \$350. The RA-111b Companion is the top-of-the-line at \$699.50. Both may be calibrated while in flight by pushing a button and both, of course, require aircraft electrical hookup. Mendenhall says his vane arrangement is virtually immune to icing. Mendenhall is the only manufacturer who is applying for certification and his selling emphasis is that his products include flap settings in the indicator information, since the addition of flaps alters stall AoA.

Advanced Flight

AFI, based in the new entrepreneurial mecca of Oregon, is owned by Rob Hickman, and was formerly known as Proprietary Software Systems. Hickman purchased the company after having learned the value of LRIs by installing one in his Van's RV-4. The company also manufactures an EFIS product that integrates the LRI. They offer two models of LRI that are self-contained. These are the Pro and the Sport models. The Pro includes flap and gear settings, aural commands for angle of attack, landing gear and installation errors and a nice echelon-type liquid crystal display. At \$1495, it's pricey, but its echelon and bar graphs look great in the panel and the safety of the aural gear and stall warnings may be worth it when things get busy. The Sport is a basic model with an LED bar graph presentation. At \$890, it offers the same aural commands as the Pro, but with a simpler indicator. You can see both models at www.advanced-flight-systems.com. What sets Advanced Flight Systems' product apart is the source of the information for their processors. Rather than a probe, they go directly to the airfoil by drilling two .040-inch holes at specific locations on the top and bottom of the wing.



Whether this is a marketing gimmick or not, it results in a clean way to obtain differential pressures. Pilots with high-performance aircraft might go the extra bucks for this feature.

The Advanced systems look to us to be more difficult to approve on certified aircraft, but the company really intends them for Experimentals anyway. These [IMGCAP(5)]systems tee off of the aircraft's pitot system for the basic AoA function and the Pro has multiple sensors and electrical components.

Conclusion

For such an esoteric product, we were surprised to find so many choices. These gadgets are much more common on experimentals where they also serve as a stall warning device, which homebuilts might not have. Do they make sense otherwise?

We think they do, actually. With an LRI/AoA, you can take your aircraft as close to the edge of the lift envelope as you want, safely. And there's little lag or error, as with a conventional airspeed indicator.

Our experience with the Huntington LRI in our Mooney years ago proved it easy to fly and dramatically effective at improving short field landing performance. It wasn't unusual to fly an approach slightly below the indicated stall speed, but with plenty of lift still in the bag.

The best value, in our opinion, is the basic unit from **Alpha Systems**, simply because it has a minimum of parts and installation hassle, plus the gauges are standard sized and have more durable glass lenses.

At \$450 and with no electrical entanglements, InAir's basic unit is sweet and simple and can be installed by an owner, although it may need 337 approval. The only reservations we had regarding this model were the nonstandard size of the gauge and the plastic lens.

For bells and whistles, EM Aviation's Buddy appears to be a good value at less than half of the price of the Advanced unit, but one needs to be receptive to the idea of a mechanical vane. We deem the Advanced Pro model as the most attractive of all the displays and because it uses ports rather a mast or probe, it's the cleanest to install.



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