# Safe Flight Unveils Budget AoA Indicator for Aircraft



by **MARK PHELPS**

*Out on the wing, where angle of attack really counts, the SCx lift transducer measures angle of attack with great accuracy and responsiveness.*

**July 27, 2014, 1:00 PM**

Safe Flight invented the stall warning horn in 1946, and refined the concept with its "lift transducer" beginning in 1953. Now the company is at EAA AirVenture 2014 with a new product–the SCx Leading Edge AoA (angle of attack) indicator. It's priced to be competitive with other AoA indicators, especially considering its $200 show discount. AirVenture buyers will pay $1,295 when they buy a system at the Safe Flight booth (No. 18). The regular price is still-attractive at $1,495.

**AIN** had the chance to fly with the SCx in Safe Flight's Cessna 172, and the system certainly performs. Unfortunately, the Skyhawk is necessarily registered in the Experimental category, since the SCx is still only available for Experimental and LSA-class aircraft. The company expects to have a Part 23-certified version available by year-end, but does not have a price yet and cannot take orders. The FAA has put approval for AoA indicators on a fast track, and that ought to speed the process of certifying the Safe Flight system for certified aircraft, but, for now, owners of regular factory airplanes will have to wait.

Safe Flight maintains its SCx system is superior to existing systems such as the Bendix-King KLR 10, which use pressure differential input from an under-wing differential pressure sensor, similar to the aircraft pitot static system. The sensor is typically mounted on an inspection cover site and the readings can become less accurate in slip and skid flight configurations, said Safe Flight's Ken Bannon–just the condition when a pilot needs the most accurate indication of angle of attack. Also, pressure differential systems incorporate three components; the sensor, a module that processes the pressure differential and the cockpit indicator, while the Safe Flight system has only two components.

In contrast, the SCx is based on a leading-edge transducer, which looks like a stall-warning switch. But the standard stall warning is an "on-off" switch that sends an electric signal to the horn when the angle of the wing increases in relation to the relative wind. That tipping point is usually set about five to 10 knots above stall speed. The transducer, however, moves in a graduated manner and is able to calculate

precisely how close the wing is to its “stagnation point” or stalling angle of attack, unaffected by aircraft weight, wing loading, gear configuration, air density or slip/skid. It can also show trend information–when the airplane is approaching a stall or emerging from a dangerous condition.

In the cockpit, the pilot sees a bank of LED lights, green at the top, amber near the bottom and red at the very bottom. Not surprisingly, amber means you’re “getting close” and red is the “danger zone.” There is also an audible “Geiger counter” clicking heard through the headset that increases in speed the closer the SCx shows to the critical angle of attack. Aircraft owners can mount the indicator where they want to, but Bannon recommends placing it right in the center of the pilot’s field of view so the display is constantly in line of sight, even as the pilot is looking out the windshield.

While there is obvious value in the AoA indicator at close to stall speeds, the SCx can also optimize angle of attack in cruise flight. A sliding reference arrow points to the green LED that represents the ideal AoA for cruise, and it is refined enough to have separate LED indications representing optimum cruise in still air or with or without a tailwind. The result is maximum fuel efficiency.

Another advantage for the Safe Flight system is that it is electrical, so installation is less complex than a differential pressure system, which requires running air hoses to and from the vane and the processing unit. With the SCx, installers cut a hole in the leading edge of the wing at least two feet outside the prop arc (preferably near an inspection panel), install the adjustable leading edge lift transducer, back it up with an internal doubler and then route the connecting wires to the cockpit indicator through the wing ribs’ lightening holes. Also, there is no temperature compensation required, as can be the case with pitot-static-type systems.

With the airplane leveled as per installation instructions, the installer can calibrate the adjustable leading-edge transducer to optimum placement in relation to the wing mean aerodynamic chord.

**Flying the SCx**

We took off from my home airport, Somerset Airport in Bedminster, N.J., which has a 2,700-foot runway. I was watching airspeed, with my field of view also including the AoA indication mounted on the glareshield. The indicator includes a cluster of green LEDs at the “sweet spot” for approach speed, which corresponds pretty closely to climbout speed for the Skyhawk. So that’s where the indicator stayed as we climbed

to altitude.

Bannon then let me put the unit through some slow flight, and right up to the stall. The LEDs were responsive and clearly showed where we were in relation to the stall. In steep turns and slips, the indications remained accurate. But what impressed me most was the second takeoff.

Bannon took the controls and made a short-field takeoff, with angle of attack close to the edge, still showing green, but sometimes dipping into amber territory. It was midday by the time we did this exercise, and summertime gusts were beginning to kick up. A couple of times, the AoA indicator showed red and the clicker increased in speed as a wind gust altered the Skyhawk's angle of attack–almost imperceptible to the seat of my pants, but showing clearly on the AoA. The airspeed indicator didn't budge, and even the overly conservative stall warning horn remained silent. That experience, more than all the diagrams and speeches I'd seen and heard brought home to me how valuable an instrument the AoA indicator can be, when a pilot is distracted during a stressful takeoff or landing approach.

All the conversation about AoA indicators makes sense. We have navigation instruments that precisely measure our deviation from airways in tens of feet. But when aircraft control is really critical, airspeed readings, the VSI and the stall warning horn measure only various symptoms of critical angle of attack, and they do it with measurable lag. For less than $1,500, it makes much more sense to me to go straight to the horse's mouth and measure the actual angle of attack out there on the wing, where it lives.

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