The latest generation SafeFlight SCc has a glareshield-mounted digital speed indexer with Geiger counter—like audio output. The display in the photo to the left indicates an on-speed condition for landing.

AVIONICS FLIGHT TRIAL

Safe Flight SCc: Speed Control, Plus AoA

The market is saturated with AoA systems, but SafeFlight's new SCc helps manage speed and angle-of-attack by measuring the wings' stagnation point.

by Larry Anglisano

Long FAA certification delays enabled Safe Flight Instrument Corporation to improve its first-generation leading-edge speed control/AoA system. For one, it ditched the remote computer in favor of a simpler and lighter two-piece system (sensor and display), while redesigning the cockpit display for better readability and easier operation.

The result is the third-generation model SCc leading edge sensor system, which is currently certified under the FAA's ASTM policy standards for AoA systems. We recently flew with the $1895 SCc system in Safe Flight's Cessna 172 for a closer look and liked what we saw.

LEVERAGED TECHNOLOGY

When we flew with Safe Flight's first-generation speed control system a few years ago, we were surprised that the company struggled to earn FAA approval. After all, it's no stranger to the process. Safe Flight invented the stall warning lift detection system in the 1940s, it pioneered the lift transducer system in the 1950s, plus its wing leading edge lift sensors are certified for primary stall warning detection on everything from single-engine piston models to military fighter jets. Safe Flight is also the company that essentially owns the autothrottle market, with a long list of patents and certifications as proof. In Safe Flight's defense, its earlier AoA system was introduced before the FAA developed a liberal ASTM approval process (FAA Memo AIR100-14-110-PM01), which made it easier for manufacturers to bring AoA technology to market.

The new SCc system leverages similar leading edge wing sensor technology used in Safe Flight stall warning systems. Safe Flight says a leading-edge lift transducer is the most accurate way of measuring AoA because the system is accurate regardless of aircraft weight, wing loading, turbulence or wing flap configuration. The theory in which Safe Flight's SCc measures AoA boils down to the very basic fundamentals of wing lift.

As the aircraft wing moves through the air it divides the air mass. At the center of this divided airflow is a narrow region known as the stagnation point. The location of the stagnation point uniquely represents the wing's AoA. The system's lift transducer—installed on the leading edge of the wing—senses the location of the stagnation point by means of a spring-loaded vane. Walk any airport ramp and you'll find a similar vane used for stall warning detection on a variety of aircraft, although it's not the same sensor used in the SCc system, nor is it a stall warning vane—or intended as a replacement for an existing stall warning system.

The AoA lift transducer is a dedicated electromechanical vane specifically designed to detect the location of the wing's stagnation point and then relay this signal to the indexer/computer that's installed on the aircraft glareshield. Unlike other AoA systems, the Safe Flight SCc generally doesn't require the installation of a wing flap position sensor.

The transducer measures 2.8 by 1.8 by 1.8 inches and weighs 0.3

CHECKLIST

- (+) Speed control functions are useful in all phases of flight
- (+) Speed indexer is intuitive to use and sunlight readable.
- (−) Cutting the leading edge of the wing for the lift sensor means an involved installation for some aircraft.

The SCc electromechanical lift transducer, top, is generally installed in the opposite wing of the stall warning vane. That's a rear view of the indexer/computer, with its interface cables.

pounds. The indexer/computer measures 1.3 by 2.3 by 3.4 inches and weighs 0.2 pounds.

INSTALLING IT

If there's a downside to measuring a more accurate AoA by referencing the wing stagnation point, it's the effort that might be required to mount the lift detector on the leading edge of the wing. On many aircraft, this will require the cutting of the wings leading edge to mount the sensor. (It was also an issue Safe Flight faced when it presented its first-gen AoA for FAA approval.) The lift transducer and spring-loaded vane is a single component that's installed with a mounting plate that contours to the curvature of the wing's leading edge.

The installation of the transducer and vane assembly mimics that of the company's stall warning vane. In general, the AoA transducer must be installed on the wing opposite to the existing stall warning sensor, at the same or close to the same spanwise position. While there is some flexibility in mounting location—perhaps positioning the sensor so it can be accessed from an existing inspection port in the wing—its accuracy is dependant on it being mounted at 1 percent total wing chord.

Additionally, the mounting location should be clear of any internal interference from ribs and other aircraft structure. Plus, installers need to note locations of pitot/static lines, electrical wiring, fuel tanks, fuel lines and other hardware that might interfere with the sensor. Safe Flight provides a doubler plate that also serves as a template for cutting the hole in the leading edge of the wing. Once the outline is drawn, out comes the cutting wheel. As drastic and critical as this may sound, we think any competent shop that's skilled in installing antennas, riveting and performing sheet metal repairs and other metal work can handle the installation.

The indexer/computer is installed on top of the instrument panel using a doubler and a sturdy ball mount. This enables the pilot to adjust the indexer to match the seating position. The indexer/computer interfaces with the transducer via two harnesses, which are fabricated by the installer. The system can accept 12-24 volts and can also be interfaced with the audio system for aural alerts.

The SCc system is calibrated using a two-step process. First is determining the accurate placement of the lift transducer and then performing an inflight calibration procedure using landing approach and stall warning speed data points, based on aircraft POH published speeds.

The indexer/computer has a dedicated calibration mode accessed by holding two buttons on the indexer. Once in the calibration mode, you can fine tune the landing approach indications by matching the system to the speed being flown.

FLYING IT

We flew with the system on a gusty day, which was a good way to compare the AoA indications to that of the stall warning system in the Cessna. We think most pilots will find the indexer intuitive to use and its LED annunciators and controls have been much improved over earlier models we flew. For instance, the old mechanical AoA reference marker has been replaced with an LED marker. This is a scrolling white LED arrow on the right-hand side of the indexer/computer and is used to designate a pilot-selected AoA reference. This reference is adjusted by two buttons on the side of the indexer. The top button moves the marker closer to the high AoA side (up) and the bottom button moves the marker toward the low AoA side (down) of the display.

For takeoff, set the reference marker at the center portion of the display, which represents an on-speed condition, and fly the aircraft at the POH listed airspeed for the normal takeoff. After rotation, simply keep the five green vertical and horizontal LEDs displayed to maintain the

SAFE FLIGHT'S SCC: A TICKET TO BETTER LANDINGS?

If you use Safe Flight's SCc as it's intended—which is really a speed control computer—our flight trials proved that it can lead to more consistent on-speed approaches. This, of course, can lead to a better landing flare and hopefully, a smoother touchdown. This saves wear and tear on the tires, brakes, airframe and best of all, avoids an unintended trip into the weeds—or worse. You should be able to get the same positive results from referencing a properly calibrated airspeed indicator, but Safe Flight's speed control system is simply more intuitive for dialing in the correct speed for the conditions. This also includes takeoff and climb.

In our trials, before takeoff on a gusty runway 36 at Waterbury Oxford Airport in Connecticut, the drill was to position the AoA reference marker in the center of the display, adjacent to the three-dot green indication in the center of the display. After rotation, using the SCc to maintain an on-speed climb proved far easier than flying the mechanical airspeed indicator, which was fluctuating as much as +/- 15 knots in the moderate turbulence. If you use the display as an airspeed trend indicator, you'll likely have better results getting the aircraft on speed and keeping it there.

So is the SCc an AoA, speed control computer or a stall warning system? It can actually be used for all of those purposes, even though it's not intended to replace the existing stall warning system or airspeed indicator, of course. But we think the SCc betters the stall warning system simply because the indexer/computer is an in-your-face device, positioned in the same location your eyeballs should be when taking off and landing. Once you fly with it, you'll likely be focused on it during every takeoff and landing. While we don't think it—or any other AoA system—is the solve-all for stall/spin loss of control wrecks, we're convinced it can help pilots achieve what they should be doing anyway: fly the correct climb and approach speed every time.

on-speed climb. Unlike some AoA systems that stow from view above critical airspeeds, the Safe Flight SCc is used in all phases of flight.

For example, it has a long range cruise mode with an AoA reference that is adjustable to give a reference that takes the headwind/tailwind component into consideration for max range flight. Using the POH figures for the required speed for a given tailwind or headwind component, you can set the indexer reference marker to fly the correct AoA for the conditions.

We found that flying the SCc during a landing approach is intuitive. Start by flying the aircraft by the book speeds for a given gross weight and flap setting. If the system is calibrated properly, the centermark LEDs will be illuminated to indicate a fast (green dots below the center mark), on-speed (five center dots) and slow (amber to red dots at the top of the display.)

The system also has a low airspeed awareness, or LAA mode. When the airplane reaches the near maximum limit AoA, the indexer will display two flashing red LEDs and sound an increasing frequency of the Geiger counter-like audio (if it's wired into the aircraft audio panel and or pilot headset audio.) The audio alerts will begin when one amber and one red LED are illuminated and will increase in frequency as the AoA increases. Between this low speed audio alert in the headphones and a blaring stall warning horn, a pilot really must be asleep at the wheel to allow the aircraft to stall.

TV SCc AoA VIDEO

AVweb
www.avweb.com

APPROVALS

The Safe Flight SCc is not approved for any FIKI (flight into known icing) certified aircraft. Additionally, the SCc applicability is determined by the presence of a Safe Flight stall warning system being part of the original equipment list. This includes common single and twin-engine Beechcraft, Cessna, Piper, Mooney and Grumman models.

As for installation effort, the shops we spoke with estimated it might take two days, including paperwork and calibration, to fully install the SCc and wire it into the audio system. At $110 per hour, that's roughly $1800, plus $1895 for the hardware. The $1495 model SSx is available for experimental aircraft.

Contact www.safeflight.com, 914-946-9500.