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FLYING BY ANGLE OF ATTACK

AFFORDABLE TECHNOLOGY ENHANCES FLIGHT SAFETY

New technology makes this useful safety device affordable.

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At Sun 'n Fun 2018, many companies displayed angle of attack (AOA) technologies. AOA is the angle between the oncoming air, or relative wind, and a reference line on the airplane or wing. AOA technologies are tools that help eliminate fatalities caused by flight into the lower end of an aircraft's flight envelope, typically leading to a fatal stall and spin, such as in a turn from base to final or on climb-out. AOA is useful during all elements of flight but helps saves lives when a pilot is manoeuvring near the ground. Military aviators have been flying with AOA for many decades. AOA technology was first used by the Wright brothers, using a stick, string and protractor. The U.S. military developed the technology in the 1950s, designing it to provide instantaneous cues to pilots, thereby allowing them to utilize unused wing lift during all phases of flight.

Historically, AOA technology was cost-prohibitive for the average general aviation aircraft, typically costing $50,000 or more. Now a number of avionics manufacturers are providing AOA technology through their telemetry pods, as part of their glass panel avionics or as stand-alone systems.

Flying AOA is designed to provide visual cues to the pilot, avoid flying near the stall speed, and remove the dependency of flying an airspeed. The stall speed of an aircraft will vary based upon many factors such as outside air temperature, aircraft weight, bank, attitude and Gs. Historic steam-gauge airspeed indicators are rarely tested or recalibrated, potentially creating a gap between indicated and actual airspeeds. Advances in AOA technology incorporate Heads Up Displays (HUD) to provide visual cues in the pilot's line of sight, eliminating the need to constantly divert the pilot's scan from the outside to the instrument panel.

AOA guru Mark Korin of Alpha Systems (alphasystemsAOA.com) has devoted decades of skilled aerospace engineering resources into the development of Alpha's products. Korin personally experienced a low-speed, low-altitude turn resulting in a classic stall/spin-induced impact with the ground. He lived, resulting in a personal mission to develop AOA technology. Developed over the past 19 years and made in the U.S., Korin's goal is to improve aircraft safety and educate regulators, aircraft manufacturers and pilots. Alpha System's AOA technology is designed to provide an affordable military-style AOA experience in general aviation aircraft while focusing on human-factor-driven display interfaces. Their technology is a complete solution that focuses on AOA and refines the display of AOA

information to the pilot, with more than 8,000 installations.

Alpha System's technology utilizes the FAA's NORSEE program for installation in certified aircraft. The technology supports both pressurized and non-pressurized aircraft, and is comprised of the following components: a visual cue display, which is installed on the panel or glare shield; an optional HUD display; an AOA electronics package; electrical and audio wiring; an AOA sensing probe and mounting panel; pneumatic tubing and a switch panel. With a variety of AOA displays, pilot/owners can select an interface display that they prefer. The kit requires roughly six to 10 hours of installation time and retails for $1,995 USD (plus optional components). It supports both 12- and 28-volt systems, drawing 0.25 amps at full display brightness. The system has four audio cues which can be enabled by the pilot. Optional modules provide audio interfaces for the aircraft's flaps and landing gear, as well as a pitot heat relay and a stick shaker interface.

The most popular kit is the Eagle, which has a chevron-plus-diamond style display. The technique used for flying AOA is to focus on flying to the blue donut. On final approach, if the AOA is too low, the yellow chevron will light up; you simply pull on the yoke to raise the aircraft's nose, bringing the AOA back to the donut. If the AOA is too high, the red chevron will light up, prompting you to push the yoke down. With the blue donut illuminated, the aircraft is at the correct AOA.

Adding a HUD display, or mounting the AOA display on the glare shield, allows the pilot to focus on looking out the window rather than diverting his or her sight between the runway and the aircraft's instruments. This is exceptionally useful when a go-around is executed. During a go-around, a larger number of tasks must be executed: flaps, cowl flaps, fuel pump, airspeed, engine controls, attitude, heading — all while in the lower speed side of the flight envelope. Korin has found that when the instrument is mounted on the panel, it is rarely used, but if installed above the glareshield, then the pilot quickly transitions to flying AOA rather than using the airspeed indicator.

During primary flight training, student pilots are instructed to fly based upon attitude and power, focusing on airspeed, attitude and altitude. Flying based upon AOA focuses on leveraging unused lift energy generated by the wing. Combining human factors with visual cues like a chevron-based HUD display focuses pilots on flying an AOA that keeps them out of the stall side of the flight envelope, ultimately improving flight safety.