



NAFI AOA Article

Imagine getting into your car and having to calculate driving speed every time you have a passenger or passengers. Say you had to add 1.25mph for every passenger in the car or had to add mph because it was hot or had to subtract because it was night or driving on a dirt road. We would probably end up with a glove box full of tickets or worse. Yet, pilots have to do it all the time. How many pilots know if their airspeed indicator has been calibrated at its entire range of speeds, for example calibrated at 10 kts. indicated or 20 indicated and so on? The FAA doesn't require airspeed indicators to be calibrated just pressure tested, consequently we really have no idea if our airspeed indicators are accurate, we're assuming. Why should we assume something that is so critical to the safety of flight?

Angle of attack or AoA, has been for the most part overlooked or not emphasized enough in General Aviation, most notably in small single engine aircraft and light twins. There are no specific FAA requirements for teaching angle of attack and most flight training courses pay little attention to AoA other than a very basic explanation of what AoA is. Typically the discussion ends at critical angle of attack and the student is left believing that's all there is to AoA. Some might say what else do you need to know? This deficiency has long lasting effects on the behavior of pilots through the course of their flying careers and this unfortunately is proven year after year every time we hear of another stall/spin, base to final accident or other loss of controlled flight incident. What's even more concerning is many pilots cannot explain angle of attack, one of the most fundamental aspects of flight.

Angle of attack is nothing new. In fact it's been around since the first powered flight. The Wright brothers used a piece of string on a stick protruding from their planes nose to determine the Flyer's attitude with reference to the relative wind. In 1957 the Navy fitted their aircraft with AoA indicators (not a piece of string), taught the pilots how to use the gauge and in one year fatality rates dropped 50%. Today all military, commercial and most corporate aircraft are equipped with AoA systems and have been for decades. Modern commercially produced AoA systems are frequently coupled with stick shaker/pusher, throttle quadrant over ride and elevator control systems allowing for additional stall awareness and automatic pre-stall correction.

As a refresher, this is the definition of angle of attack; technically, AoA is the angle between the airfoil chord line and the wings direction of motion relative to the air. The chord line is an imaginary straight line from the airfoils leading edge to the trailing edge. You could say AoA is the angle between where the wing is pointed and where it is actually going. Whether you're flying right side up, upside down, straight up, straight down or any combination in between, angle of attack defines an airplanes margin above and all the way to (critical alpha) stall.

All I need is an airspeed indicator. My instructor said airspeed is everything. I have 30,000 hours and never needed AoA. My airplane stalls at the same indicated airspeed every time (no it doesn't, it can't). And the best one, "I don't need no fancy gauge, I fly by the seat of my pants!" Famous last words. These are a few examples of reactions heard from pilots when discussing AoA. What would you do if the airspeed indicator malfunctioned or the pitot/static system was damaged and failed? Would you wait for the "buffet"? Can you feel the onset of an accelerated stall? The airspeed indicator is arguably an important flight instrument, but it is flawed under many circumstances. These flaws are often times revealed at the most critical times of flight, low airspeeds and low altitudes. Airspeed is the result of angle of attack, but airspeed indicators don't tell the whole story, angle of attack does.

Here are just a few examples of how AoA can help train flight students. As we all know one of the greatest challenges in training new flight students is building or developing perspectives, especially during landing. Using an AoA will clearly show the student if their angle for approach is correct. If not, it will assist them in making proper corrections. Locating the AoA display in the students' peripheral vision will allow the student to keep their head up and looking out of the plane during this critical time. AoA can be particularly useful during stall training as well. As angle of attack is increased the AoA indicator will show the loss of lift instantly right up to stall, consistently, at which time the student will recover normally. AoA will give the visual and even an aural indication leading up to the stall providing the student some level of comfort in anticipation of the screeching stall horn. Another benefit rarely if ever discussed is how AoA can be helpful for the non-pilot passenger. Because of AoA's simplicity, a short explanation of how the AoA works can help the passenger believe their chances to land the plane safely are much greater in the event anything were to happen to the pilot. Sounds like a nice addition to a future "Pinch Hitter" course. AoA will increase the opportunity to enhance and potentially reduce training time for student pilots.

Here are a number of reasons a pilot should have angle of attack in their plane.

1. AoA lets you know immediately whether the wing will support the aircraft or not. In other words, how much lift is available to you.
2. At high angles of attack, accurate airspeed indications are difficult due to position error.
3. AoA is not affected by gross weight, bank angle, load factor, speed or density altitude.
4. AoA will indicate proper approach speeds under all conditions of weight, CG, flap position, air density, turbulence or angle of bank.
5. AoA can instantly detect wind shear, immediately suggesting a solution.
6. When properly used, AoA can identify exact pitch attitude for best angle or rate of climb.
7. AoA can also indicate optimum long-range-cruise pitch attitude.

One of the major obstacles to getting GA airplanes equipped with AoA indicators has been cost. For many years the only systems available were very expensive and complicated. These type AoA systems require flight computers, multiple vanes and major modification to the aircraft. Another challenge has been the FAA and FSDO's. Through its confusing language, questionable interpretation and arbitrary enforcement of the FAR's the FAA and FSDO's have discouraged or prevented the installation of AoA in GA aircraft. Fortunately this is starting to change through the efforts of some at the FAA and in the aviation community.

Alpha Systems AOA is a Ramsey, Minnesota based, privately funded company who has been in business since 1996. **Alpha Systems AOA** has engineered and also manufactures the most comprehensive, accurate and affordable angle of attack system and displays for general aviation aircraft on the market. President of Depot Star, parent company of **Alpha Systems AOA**, private pilot Mark Korin began development of an AoA system after a low altitude stall and crash in an ultra-light. Fortunately Mark walked away from the incident but felt there was another, more reliable way that crash could have been avoided.

Knowing the inconsistencies and vagaries of airspeed indicators Mark Korin decided that the ability to identify angle of attack inside the airplane was the solution to many of the most common and preventable accidents in aviation. Throughout the majority of Mark Korin's aviation career he has been on a mission to give pilots the ability to measure angle of attack and save lives. With a 30 year background in medical device engineering and a passion for aviation he has been able to successfully design a reliable and repeatable angle of attack system. One Mark Korin's closest supporters Mr. Fred Scott, feels just as passionate about angle of attack.

Mr. Scott who is an experienced pilot himself, has endured the tragic loss of 3 close friends as a result of stall/ spin accidents each of whom did not have AoA in their planes. Upon learning of **Alpha Systems AOA** Mr. Scott decided to launch a major AoA campaign starting with extensive flight testing in his own aircraft. To help bring angle of attack awareness to General Aviation Mr. Scott donated many **Alpha Systems AOA** to flight schools and devoted a large part of his website to **Alpha Systems AOA** and angle of attack education which can be found at www.ballyshannon.com/aviation. In addition to Mr. Scott's advocacy of AoA he has been active in helping change the way the FAA looks at angle of attack systems in GA aircraft. Through his and many others communication on the benefits of angle of attack with the FAA, the Small Airplane Directorate in December 2011 issued a letter stating normal installation of **Alpha Systems AOA** is to be considered a minor alteration requiring a logbook endorsement from an A&P or I.A. This eliminates the need for a 337 or STC still allowing **Alpha Systems AOA** to be installed in certified aircraft.

Alpha Systems AOA has greatly simplified the process and significantly reduced the cost of installing AoA in general aviation aircraft. Thoughtful engineering, superior materials, pilot minded design and relative ease of installation make it the premier AoA for GA aircraft. **Alpha Systems AOA** has the largest selection of AoA displays available on the market with 12 highly functional displays currently and 3 more systems in development. In addition, **Alpha Systems** has enhanced (audio) displays, a pressurized system, heated probes, dual cockpit displays and more, allowing **Alpha Systems AOA** to meet the needs of any general aviation pilot. **Alpha Systems AOA** is installed in planes from Cubs to King Airs including Warbirds such as the P-1D Mustang, Supermarine Spitfire, T6 Texans, T28 Trojans and others. Custom mounting plate fabrication is also available upon request for unique installations like the Grumman Widgeon that was just recently fitted with **Alpha Systems AOA**.

The AOA probe for the **Alpha Systems AoA** detects the changes of differential air pressure. The differential in air pressure is then converted to an electronic signal through the interface module which is then in turn sent to the display mounted in the cockpit. The probe mount system is riveted onto an anodized aluminum mounting plate which is fully adjustable and lockable. Also, the probe itself has no moving parts removing the potential for wear. One of the major factors in allowing installation to be considered a minor alteration is the probe mount. The probe mount is designed to replace an existing inspection port plate on the bottom of the wing

making installation simple. For twin engine use, the probe can be mounted in the nose of the aircraft if a wing inspection port is not available.

The **Alpha Systems AoA** is a closed, standalone system that does not require or depend on the existing pitot/static system. This autonomy from the rest of the aircrafts instruments provides redundancy in the event the pitot/static system is damaged or disabled. Electrical load is minimal with a power requirement of less than a ¼ amp. Total weight the system is just under 2 ½ lbs. and does not require new weight and balance of the aircraft. **Alpha Systems AOA's** unconditional warranty is unmatched in the AoA market. Also, **Alpha Systems AOA** offers a trade in program that grants a \$160.00 credit with the exchange of any old AoA system.

The advantages and benefits of flying by AoA are nearly unlimited. Though still considered a secondary instrument it is quickly gaining credibility and popularity. To date **Alpha Systems AOA** is installed in thousands of aircraft. Those who have installed and fly with this AoA system wonder how they ever did without. Whatever your persuasion, it is indisputable that AoA has and will continue to save lives. For more information on **Alpha Systems AOA** visit www.alphasystemsaoa.com.