



# Angle of Attack

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## A Long Term Plan of “Attack”

By now you have likely heard of the FAA’s policies that make it easier to install a potentially life-saving device on your aircraft — the angle of attack (AoA) indicator system. These small but extremely valuable devices warn pilots of an impending aerodynamic stall. Policy guidelines published by the FAA in 2014 streamlined the approval process and deemed the installation of certain AoA devices as a minor alteration. This was welcome news for pilots who may have been interested in acquiring these devices, but who were otherwise prohibited by the costly installation and approval process.

So with many GA aircraft now boasting this new technology (or operators preparing to do so), what can we say about its effectiveness in preventing loss of control situations? Are we seeing beneficial behavior changes? How about its intuitiveness? And with so many products now available, how is standardization being addressed?

The answers to these questions (and more) are all part of the FAA’s long term action plan for studying AoA systems and providing additional policies and guidance for their use and installation. Given the magnitude of AoA research that is needed, not to mention the aspects of the AoA systems we’re still unsure of, the FAA has conducted research with partners in government, industry, and academia. The FAA’s PEGASAS (Partnership to Enhance General Aviation Safety, Accessibility, and Sustainability) program is a contributor to that research effort, working directly with students and faculty from a core group of universities across the nation ([www.pegasas.aero](http://www.pegasas.aero)).

Spearheading the AoA analysis efforts within the FAA are the Aircraft Certification Service’s Small Aircraft Directorate and the William J. Hughes Technical Center. “We have several ongoing and recently completed FAA research projects pertaining to general aviation AoA systems,” says Robert McGuire, manager of the Flight Controls and Mechanical Assistance Program. “To help us with these projects, we routinely leverage the help of industry experts and research labs all over the country.”

A good example of that teamwork is evident with the agency’s work in studying derived AoA data from Attitude Reference Heading Systems (AHRS) on GA aircraft. This project aims to characterize AoA data that is inferred by aerodynamic modeling and software algorithms (as opposed to those systems

that measure AoA mechanically) and develop minimum performance standards for that equipment. The FAA’s partners with this endeavor include Aspen Avionics, and, Texas A&M and Ohio State University from the PEGASAS team. Testing is currently underway that will look at how derived AoA data can be impacted by sensor characteristics, vehicle dynamics, and air mass motion. In a similar study, Adaptive Aerospace Corp. is researching how derived AoA data compares to AoA that is sensed mechanically.

This research is also helping to aid development of a flight envelope protection system that will work in concert with an AOA sensor and prevent pilots from making improper control inputs during critical situations. In fact, the FAA has already designed, built, and flight-tested a low cost prototype envelope protection system for GA aircraft that is capable of being retrofitted into existing GA autopilot systems and is participating in an experimental flight test program with LAM Aviation on an AoA limiter system. (Your days are numbered loss-of-control!)

Another area of concern with AoA systems is the operational consistency between different makes and models, as well as baseline interpretability. Status indicators on some models are visual, or aural, or both. You might get anything from flashing red arrows with a Siri-like voice saying you’re angle is too high, to hearing a Geiger counter sound like you’re flying over Chernobyl. Studies hope to show and determine the level of standardization that needs to exist with AoA status displays, symbols, and nomenclature, as well as determine baseline training and education requirements. The FAA is already well on its way toward building familiarity with these different features and functions having flight tested and categorized (with the help of partner Skyward Bound LLC) 80 percent of the commercially available AoA sensors.

To address the issue of cost for AoA devices, the agency hopes to have some changes in place by 2018 that would continue to simplify the certification process and, in turn, provide more affordable options for pilots.

Stay tuned for more on the FAA’s plan of “attack” for AoA. For additional information on AoA projects, contact Dave Sizoo ([David.Sizoo@faa.gov](mailto:David.Sizoo@faa.gov)) at the FAA’s Small Airplane Directorate or Robert McGuire ([Robert.J.Mcguire@faa.gov](mailto:Robert.J.Mcguire@faa.gov)) at the Tech Center.