



## Angle of Attack (AOA) Systems

Precise, reliable measurement and display of Angle of Attack (AOA) from takeoff to landing can substantially improve aircraft performance as well as assure a safe operating margin above stall speed.



Angle of attack is defined as the angle formed between the wing chordline and the direction of air flowing past the wing. At any specific AOA, the airflow over some percentage of the wing surface will generate lift as well as some amount of drag. Maximum lift is usually obtained at a relatively high angle.

Stall is defined as the condition which arises when the angle grows so large that the flow is completely disrupted and not enough lift is generated to overcome the weight of the aircraft. This AOA, the stall angle, is constant for a particular aircraft, although various wing designs stall at differing angles.

The amount of useful lift and drag generated by any wing at some specific AOA will depend upon the influence of such variables as the wing geometry, density altitude, aircraft gross weight and velocity. However, the ratio of lift to drag coefficients at a given angle remains constant. Therefore, the theoretically ideal ratio of lift and drag coefficients for any flight maneuver will always be found at the same AOA under all speeds or load conditions.

# Angle of Attack (AOA) Sensors

## Model 0012 AOA Transmitter

This precision flow angle sensor is specifically suited for wing mounting on a conventional single-engine or multi-engine aircraft where a suitable fuselage location cannot be found. It features a pivoting swept-vane element extended on a boom from the wing's leading edge, where it's free of prop wash or other flow disturbances. For all-weather service, Model 0012 transmitters can be furnished with thermostatically-regulated, 28-volt heaters for the vane, boom and nose cone. These heaters meet or exceed military specifications for de-icing performance. This unit is in use on aircraft from turboprops to supersonic fighters.

### Specifications

Operating Range	Typically +5°F to +149°F (-15°C to +65°C)
Weight	1.25 lb. max. / 567 g
Output	Potentiometer
Heater Power	425 watts



## Model 0861 AOA Transmitter

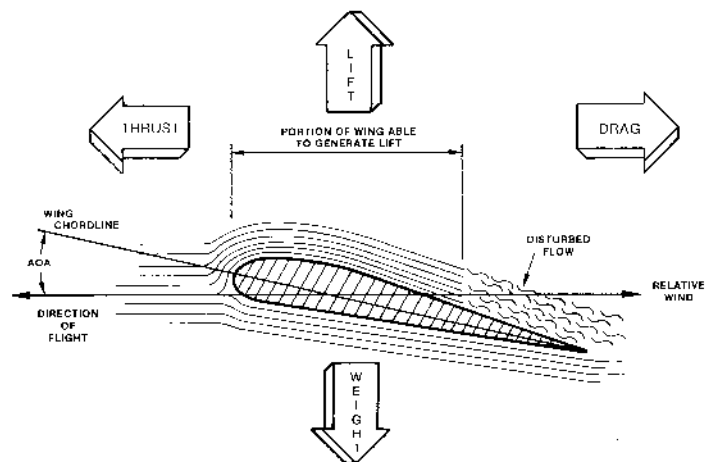
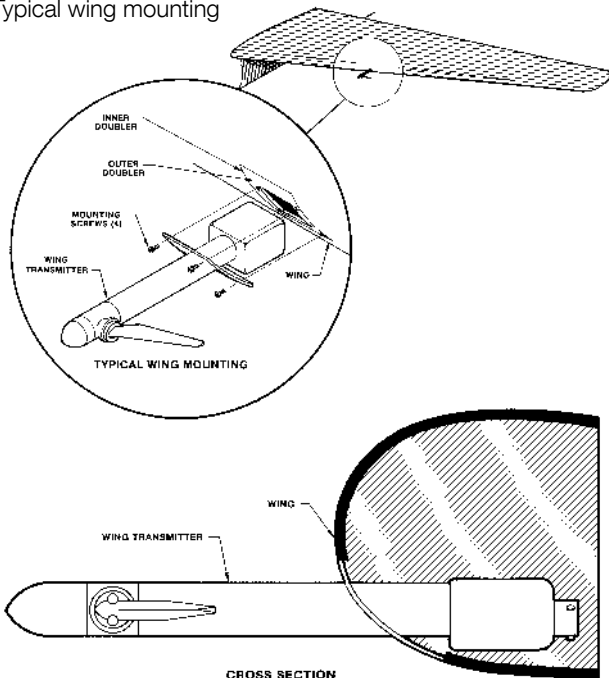
This swept vane angle of attack transmitter is aerodynamically aligned, has high reliability, low maintenance requirements and superior performance. Our patented swept tapered vane minimizes aerodynamic drag and provides excellent dynamic response, exhibiting negligible overshoot in turbulent conditions. Model 0861 is electrically de-iced by a solid state heater and demonstrates improved low air-speed sensitivity over less modern designs. These self-regulating heaters do not require thermostats, thereby lowering system complexity and increasing reliability.

### Specifications

Operating Range	As specified by user
Weight	3 lb. max. / 1.4 kg
Output	Synchro or resolver, RVDT or potentiometer
Heater Power	115 volts, 400 Hz
Certification	TSO-C54



Typical wing mounting



# Angle of Attack (AOA) Sensors

## Model 0020 Electronic Signal Conditioning Module

This module, when used with either Model 0012 or Model 0861 AOA transmitters, supplies regulated power to transmitter potentiometers and internal circuitry which processes transmitter signals. Model 0020 can be specified to have outputs for controlling a number of indicators, indexes and stall warning devices. Model 0020 operates on 28 VDC power and features modular, plug-in electronics for easy servicing. Circuitry for flap position inputs and a press-to-test function are optional.

### Specifications

<b>Temperature Limits</b>	Operating -65°F to +160°F (-54°C to +71°C) Nonoperating -85°F to +160°F (-65°C to +71°C)
<b>Weight</b>	3 lb. max. / 1.4 g
<b>Power</b>	10 watts max.



## Model 0031 Approach Indexer

Model 0031 indexer provides a heads-up display of AOA information during critical approach and landing maneuvers. This unit is designed to be mounted on the glare shield for easy visibility and quick reference. Three color coded symbols are lighted in various combinations to indicate a fast, on-speed or slow approach. The unit operates from the same AOA signal used to control the AOA indicator. One or two indexers can be controlled with Model 0020 in conjunction with one or two AOA indicators and other options. Model 0031 conforms to MS25317 and MIL-L-6723. U.S. Air Force and U.S. Navy standard color codes are available.



## Model 0032 AOA Indicator

The design of a complete angle of attack system would include the Model 0032 AOA indicator along with our 0020 AOA computer, 0861 AOA sensor and 0031 indexer. During flight tests, all necessary data will be obtained to allow for calibrating the AOA computer and for establishing the indicator dial face design in order to match the unique performance characteristics of a particular aircraft. Once calibrated and equipped with a new dial face, the indicator will accurately display compensated AOA and stall margin. This data is very useful to the pilot during approach or when executing maximum climb maneuvers.

### Specifications

<b>Lighting</b>	5 VDC at 1.5 watts max.
<b>Case</b>	Standard 2 in. (5.1 cm) flanged



## Model 0030 AOA Indicator

Model 0030 AOA indicator provides the pilot with a highly accurate, easy-to-read display AOA for various aircraft configurations. The dial face of the indicator displays cruise, takeoff or approach, stall warning and stall markings. It provides the drive power to AOA potentiometers and combines the circuitry of the Model 0020 with the display of the Model 0032. During wind shear recovery, the aircraft is rotated to the optimum AOA. The pilot is relieved of the duty to search for stick shaker by pitching up in small increments, saving valuable time and altitude.

### Specifications

<b>Lighting</b>	Standard 5 volt, 400 Hz
<b>Case</b>	Standard 3ATI
<b>Power</b>	115 volts, 400 Hz



# Angle of Attack (AOA) Sensors

## Enhanced Anti-Icing Capability

Accurate Angle of Attack (AOA) measurement in all environmental conditions is important to maintain performance and safety. EASA updates to CS 25 now require AOA sensors to operate successfully in the newly defined ice crystal requirements, commonly referred to as Appendix P from CS 25 (similar to Appendix D from FAR 33). Patented AOA sensor technology has been developed to effectively manage all types of moisture content without impacting sensing capability. AOA can be sensed throughout the flight envelope with minimal added power. New fixed wing platforms and those seeking increased robustness in icing conditions can greatly benefit from this capability.

## State-of-the-Art Testing Capabilities

UTC Aerospace Systems has one of the most capable icing wind tunnels in the world. Aerodynamic and icing testing is essential to analyze the effectiveness of air data products. The new icing wind tunnel allows UTC Aerospace Systems to meet the new, stringent icing requirements for air data probes set forth by the world's aviation regulatory agencies. It offers significantly increased capabilities, such as colder temperatures and higher altitudes, and is capable of producing both solid ice particles and supercooled liquid water droplets in high concentrations. Extensive wind tunnel testing allows us to optimize the design for performance throughout the flight envelope and environmental conditions experienced in flight.



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