Angle of Attack Displays Could Enhance Safety

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An angle of attack indicator is needed in the cockpit of every airplane, according to many pilots. "It's the most useful piece of information you can get," declared Capt. Ron Rogers, an A320 pilot.

The measure is so critical that the only flight instrument on the Wright brother's first airplane was a device to measure angle of attack (AOA). The Wright's crude instrument consisted of a stick protruding forward of the wing's leading edge with a length of yarn attached to the front end. The AOA was measured by the position of the yarn streaming back relative to the stick.

Modern aircraft measure angle of attack with more sophisticated sensors, feeding the data to their flight management systems - and to the "stickshaker" to warn of the approach to stall. But the information remains locked in the computer. To ensure safe flight at a speed that correlates to a desired angle of attack, pilots often are provided a set of speed cards. A card for each aircraft gross weight outlines the indicated airspeed to be flown. The shortcoming of this approach is that it does not account for the variance between estimated and actual aircraft gross weight (the sudden application of power often seen just before touchdown is a last-minute pilot response to holding a constant airspeed in an airplane that is heavier than estimated). However, if a pilot finds that he's actually flying 10 degrees AOA, not the 8.5 degrees AOA implied on the speed card, he knows the airplane weighs more than reported.

Angle of attack information also adds a margin of safety when flying in a holding pattern. An increasing AOA can warn of icing. Even with a "clean" wing, the additional wing loading of a turn at low airspeed can put an airplane into a stall at the blink of an eye. An AOA indicator provides warning.

An AOA indicator also can help prevent emergencies from devolving into crashes. In 1996, a Birgenair 757 crashed 2.5 minutes after takeoff from the Dominican Republic. Water in the pitot tube feeding the captain's airspeed indicator was suspected. With conflicting airspeed indicators and an autopilot/autothrottle reaction that increased pitch and lowered thrust, the crew disconnected the autopilot and applied full power, but too late to skirt catastrophe. A few months later an AeroPeru 757 crashed into the waters off Lima under circumstances that represent the flip side of the Birgenair tragedy. Investigators found the static ports had been taped over as ground crews waxed the plane's aluminum exterior. Left undetected, the taped-over ports rendered the airspeed indicators useless.

To be sure, in both cases the pilots could have resorted to a constant pitch/known power setting to fly out of an incipient stall, but hindsight presumes a presence of mind not always present when crews are caught by surprise. In both of these tragedies a direct angle of attack readout could have been a real lifesaver. In truth, according to advocates, an angle of attack readout complements the stickshaker. The latter tells the pilot that he's gone and done it, while the former helps him to avoid doing it.

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