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THE ENVELOPE, PLEASE!

Smart Autopilots to Improve GA Safety

The FAA and industry are constantly working together to enhance safety for general aviation (GA) aircraft. Several new "smart" autopilots that leverage the attitude sensors in existing glass displays in GA aircraft are helping to achieve that goal.

Early studies of GA safety under the AGATE (Advanced General Aviation Transport Experiments) concluded that pilots needed better information in the cockpit to enhance safety. The revitalization of GA and the glass display revolution over the past 10 years have provided weather, terrain, traffic, and other information to reduce GA accidents and enhance pilot awareness. Ironically, even with all this great technology coming into small aircraft, loss of control accidents continue to cause fatalities. So the next big thing is to make airplanes easier to fly. Smart autopilots can help keep pilots from ever getting into bad situations, such as extreme attitudes where loss of control can occur, or from getting too fast or too slow.

Courtesy of Avidyne

Smart Systems

Enter the smart autopilots like the Avidyne DFC-90 and the Garmin GFC700 with electronic stability and protection (ESP). These devices bring features into small aircraft that have traditionally been available only in complex fly-by-wire flight controls in large commercial transports, or in very expensive military fighters. The difference is that these systems are simply meant to help the pilot stay out of trouble in the first place. They act like an instructor pilot, and assist with limiting the aircraft to a smaller portion of the existing certified envelope. Using attitude data from the installed AHRS (Attitude Heading Reference System) common to the new glass displays, they monitor bank angle, pitch attitude, and speed limits enforced by the existing autopilot. Some even use smart servos to provide a force gradient into the controls, a feature designed to coax the pilot back to a wings-level or level flight attitude, just as a flight instructor might do.

These systems still allow the same maneuverability in an emergency, and maximum performance in pitch all the way to stall, if the pilot needs it. However, they help the pilot stay away from potentially dangerous situations by enhancing stability and by giving the airplane a self-righting tendency when the controls are released. These systems are designed to help the pilot keep the aircraft in a safe, stable flight condition, and to prevent stalls/spins, over-speed, spirals, or other loss-of-control conditions if the pilot becomes disoriented, distracted, or incapacitated.

Certification Challenges

The challenge for certification of these systems was to overcome the traditional thinking associated with certification of complex fly-by-wire systems. In large aircraft, fly-by-wire is typically considered a critical system that cannot be allowed to fail. This consideration drives the cost of certification and the complexity of the system to a point where the technology would not be affordable to GA. In contrast, GA autopilots are typically treated as non-required equipment. So, as long as they can't hurt the airplane, their certification requirements are less stringent than complex flight controls for commercial transports. In GA, the FAA focuses on their ability to track an intended flight path without causing any hazard to the airplane or hazardous deviations from controlled flight. To remain consistent with this philosophy, recently certified smart autopilots like the ones mentioned earlier are designed so if the system fails, the airplane simply goes back to behaving in the same manner pilots are accustomed to when hand flying, with the same stall speeds and capabilities available.

A little protection never hurts, and the FAA is excited about the potential this new twist on an old idea provides for enhancing safety. New sensor and servo technologies make it all possible. We continue to look at ways to allow better automation to improve the way we fly, facilitating more personalized use of aviation. Smart autopilots are just the beginning, and technology is coming from the unmanned aircraft industry that will continue to provide safety enhancements, challenge traditional certification processes, and improve automation in GA. Stay tuned!

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