STALL/SPIN RESISTANCE - A NEW CONCEPT?

Ask your typical pilot about the stall and spin characteristics of the airplane he flies and the response will likely range from "Very good" to "It has a nasty stall break - but I can handle it." Among detailed descriptions, however, is spin behavior is almost academic because it is not taught or even demonstrated in most pilot training curricula. Statistics indicate that many pilots in fact don't handle stalls and spins well in real emergency situations. Nearly 20 percent of all fatal general aviation accidents involve stall/spin scenarios.

Emphasis on training and stall/spin awareness is surely helping to keep the statistics from becoming worse but there is little incentive or pressure to motivate better airplane design. Aircraft certification for stall behavior emphasizes a nose down pitch change accompanying the stall and certification for spin behavior focuses on the number of turns required for recovery after application of anti-spin controls. There is also a certification clause that permits spin proof airplanes, such as Fred Weick's Ercoupe of the 1940's. In the Ercoupe the horizontal-tail power was designed to be less than that required to stall the wing at aft center-of-gravity locations. The low tail power, however, also restricted trim capability for the forward center-of-gravity limit and thereby compromised the utility of the airplane. Over the years, several control concepts have been designed and evaluated to limit tail power during critical phases of flight but none have yet reached the market place in general aviation.

Now along comes the idea of stall/spin resistance being promoted by NASA. Is it new? No, not really. Will it eliminate stall/spin accidents?
Probably not entirely. Will it improve the accident record significantly? We believe so. The NASA concept of stall/spin resistance approaches the spin proof philosophy by extending the usable angle-of-attack range of the wing rather than limiting tail power. The most successful concept so far consists of a simple but carefully engineered drooped leading-edge extension to the outer wing section. Flight experience on three typical single-engine airplanes has demonstrated that the outboard section remains unstalled to extreme angles of attack (greater than 35°), thereby providing exceptional roll control and resistance to spin entry. By comparison, the conventional practice of employing wing twist and planform to control the tip stall usually results in wing stall in the neighborhood of 15°-20°. The bottom line of the NASA approach is that the research airplanes tested are very highly resistant to stall departure and spin entry. Stall attempts are characterized by a noticeable buffet onset as the inboard wing section stalls which continues to increase in intensity until full elevator power is reached. Only on rare occasions, at rearward center-of-gravity, and using unrealistic entry controls have the NASA test pilots been able to stall the entire wing. As for spins, over 400 spin attempts were flown by NASA pilots, and less than 5 percent of these attempts resulted in spins, compared to more than 95 percent for the basic airplanes. This technology applied to single-engine general aviation designs would all but eliminate the inadvertent stalls that often occur in the traffic pattern and which dominate the stall/spin accident statistics. The problem is that "stall resistant" airplanes may not meet the existing certification requirements for either the recoverable or spin proof categories. A new category is needed that permits relief from the current
recovery criteria if other characteristics such as resistance to spin entry offer an overall increase in safety.

In order to encourage this technology, the FAA, industry and NASA must work together to develop a recognition of the safety potential and the certification criteria that will permit its exploitation. Stall/spin resistance may not be a new concept, but the time appears right to exploit the technology. Statistics indicate that many pilots in fact don't handle stalls and spins well in real emergency situations. Nearly 20 percent of all fatal general aviation accidents involve stall/spin scenarios.