

## AIN Blog: Simulator Vs. Airplane Upset Training

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***Preparing for the next upset training maneuver in Flight Research's Sabre 60. (Photo: Matt Thurber)***

For the longest time, sophisticated and multimillion-dollar full-motion flight simulators have not been terribly useful for an important element of pilot training: flight outside the normal flight envelope and especially full stalls. Most simulators don't have the aerodynamic modeling for beyond-the-normal-envelope flight, whether because the aircraft manufacturer didn't supply this data or because the simulator manufacturer couldn't justify the expense of doing its own flight-testing to support these flight regimes.

There is growing interest in using flight simulators for upset training and teaching pilots how to recover from loss of control, but to do so the simulators must be equipped with the proper aerodynamic modeling. This is now happening, and part of the reason is that beginning in March 2019, U.S. Part 121 pilots will be required to undergo full stall recovery training in simulators to conform with the mandate by Congress in the Airline Safety and FAA Extension Act of 2010, which is the same law that requires all Part 121 pilots to have an ATP certificate. The FAA has also updated Part 60 simulator rules to introduce "new technical standards for full stall and stick pusher maneuvers, upset recognition and recovery maneuvers, maneuvers conducted in airborne icing conditions, takeoff and landing maneuvers in gusting crosswinds, and bounced landing recovery maneuvers."

Business jet pilots so far are exempt from the new Part 121 rule, although they will be exposed to upset prevention and recovery training during their ATP training. Many flight operations are sending business pilots to upset training programs, which range from in-airplane training using aerobatic airplanes and even business jets to simulators that now can model the full flight envelope, including deep stalls and high-speed upsets.

FlightSafety International was first to incorporate such aerodynamic modeling in one of its simulators, a G550 done in partnership with Gulfstream. Other FlightSafety simulators are getting the same treatment. CAE is working on this, too, and it won't be long before simulator-based upset training well outside the normal envelope is available for a wide variety of airplanes, after the new Part 60 rules take effect. Of course, Aviation Performance Solutions has been using regional jet simulators for a long time in its upset prevention and recovery training courses, by putting pilots in the simulator and replicating typical airliner-type edge-of-the-envelope upset scenarios in the simulator following flights in the company's aerobatic Extra 300s.

In the past year, I've attended both the FlightSafety G550 simulator-based upset-training program and Flight Research's in-airplane program in a Sabreliner 60 and Aermacchi Impala military jet trainer. The question I most often get after participating in these programs is which is better for upset training, the simulator or the airplane?

There is no clear answer, because both types of training are beneficial, and there are advantages in either case.

What I liked about the G550 simulator training at FlightSafety's Savannah learning center was the ability to replicate actual accident scenarios right down to the ground. While it is not possible for training purposes to stall from a low altitude and crash in a real airplane (well, not impossible, but not recommended), this is easily replicated in a simulator with proper aerodynamic modeling. In one scenario I stalled the G550 at 800 feet agl and had to try to recover. The visual display makes the sense of "about to smack into the ground" plenty realistic, and it took me a few tries to learn how to finesse the controls to avoid a secondary stall and crashing. The other scenarios that we practiced were equally compelling and instructive. One involved using bank to recover from high angle-of-attack induced by stuck pitch control, and this exact maneuver has proved a lifesaver in the runaway-trim situation that confronted the crew flying a Falcon 7X in May 2011.

The upset training in the Flight Research Sabre and Impala proved equally beneficial, in my opinion. We stalled the Sabre and held the yoke fully aft, allowing the stall to develop fully. This is something that can't be done in most medium and heavy jets, and it allowed me to feel the full stall and all of its perturbations, something that can't be duplicated in any simulator. The other maneuvers that we performed in the Sabre underscored another difference, and that is the ability for the pilot to feel the real g loads in the airplane. While we couldn't do any radical maneuvers in the Sabre, we certainly did in the Impala, and these helped me learn how to react promptly and correctly to situations where I was upside down and headed to an even

worse condition if I didn't do something. Again, this is a situation that is difficult to replicate in the simulator. Obviously we did all of these maneuvers at a safe altitude.

My conclusion? If I were the head of a flight department, I would definitely include upset training as part of our regular recurrent training program. And I would alternate between the in-airplane and simulator-based training so pilots could get the benefits that both offer.