By Robert Hadow

Hangar flyers everywhere owe the NTSB a cold one for stimulating discussion that will last through the summer. In March we read, “NTSB STUDY SHOWS INTRODUCTION OF ‘GLASS COCKPITS’ IN GENERAL AVIATION AIRPLANES HAS NOT LED TO EXPECTED SAFETY IMPROVEMENTS.” The Board went on to describe six recommendations to the FAA for improved training.

In the interest of journalistic integrity, let me disclose my biases before we start. I instruct every day in both conventionally equipped and G-1000 equipped Diamond airplanes. As you might expect, I am in favor of more training. I’m opposed to sloppy statistics and unwarranted conclusions.

The National Transportation Safety Board met in a sunshine session 9 March 2010 to discuss a year-long study its staff had made of the relative safety of late-model aircraft equipped with conventional and glass panels.

The statistical comparison examined only one difference between accidents – whether a digital flight display (“Glass Cockpit”) changed the accident rate compared with similar aircraft with conventional instruments (“round dials”). It compared the total accident rate and fatal accident rate for a sample of 2002-2006 model aircraft over the years 2002-2008.

The key finding was summarized in two slides displayed at the meeting [editor’s note: the NTSB posted two different version of the slide deck on its website]. The slide on the right – fatal accident rate, 2006-2007 – was the one that stimulated the most discussion.

NTSB Member Sumwalt questioned the staff on its findings, referring at times to portions of the full report, which was not to be available to the public for several weeks. Sumwalt pointed out that the weather and mission were substantially different between the conventionally equipped cohort and the glass cockpit cohort. The conventionally equipped aircraft were likely to be flown within 25 miles of the home airport, in VFR, on training flights. The glass cockpit aircraft were flown more often on longer personal and business flights, more often in IMC, single-pilot IFR.
In 2007-2008, an aircraft equipped with electronic primary flight display was 2.3 times more likely to be involved in a fatal accident. Staffer Loren Groff, PhD described the reliability of his conclusion as p=0.004. There are four chances in a thousand that his conclusion is a statistical fluke.

That may be true, but it doesn't tell us anything useful. Longer trips into IMC, single pilot IFR? Sure, you will have more fatals. Just because an electronic primary flight display was on board doesn't mean it was the cause.

Yes, the digital flight display may have had something to do with it, but if you don’t normalize for weather and mission, you can’t draw a conclusion. One vicious observer recommended that the NTSB perform a similar study to see if TACAN radios had an effect on fatal outcomes in 1966-1972 Cessna O-2 and 337 aircraft. The O-2s crashed regularly, but it wasn’t caused by the TACAN. It was small-arms fire.

In statistical terms, conventionally-equipped aircraft was the control group. Glass-cockpit aircraft was the response group. In a well-designed cohort study, the two groups share all the same characteristics, except the independent variable under study, the panel. In the NTSB study, the aircraft were similar in make, model, and age. In this study there was a host of confounding variables – factors that could easily explain the results as easily as the panel – weather, pilot age, crew composition, length of trip, and aircraft speed.

NTSB member Sumwalt asked the key question: If the weather were the same and the mission were the same, how would that change the conclusion? Groff was unprepared to answer definitively. He admitted that he couldn't answer that. He couldn't or wouldn't do that analysis over the last year.

Sumwalt was insightful and kind. He discontinued his line of questioning. A college professor would have failed the sophomore who submitted work like this.

The single valid conclusion one can draw from this study is that the airplane equipped with a glass panel was more likely to come to a nasty end. The converse is also true: a round dial airplane, likely with an instructor on board, flying in VFR conditions within 25 miles of home was less likely to be involved in a fatal accident. THE NTSB STUDY GIVES NO, NO, NO REASON TO BELIEVE THAT YOUR NEXT FLIGHT WILL BE ANY MORE OR LESS SAFE BECAUSE YOU HAVE A G1000.

The hearing focused on fatal accidents during a two year period. It’s worthwhile to put this into a longer term perspective. The AOPA Nall Report describes the fatal accident rate for the entire GA fleet in the years 1998-2007 varying between 1.11 and 1.38. The NTSB finding of 1.03 isn’t so bad. In fact, it represents a small increase in safety.

Before you pull out the lawn chairs and start arguing, it is worthwhile to review the terms of the discussion. Glass Cockpit is defined as an airplane equipped with digital primary flight display. Typically, that means an LCD display with airspeed and altitude tapes instead of round dials. Glass cockpit is not synonymous with TAA (technologically advanced aircraft) which, by definition, means only that the cockpit is equipped with a moving map GPS.

Accident rate is a measure of reported accidents divided by hundred thousand hours of flight. AOPA uses overall consumption of fuel as its measure of aircraft use. The FAA uses its own GAATAA survey data to estimate aircraft use.

When the discussion heats up at your airport, there will likely be four topics of discussion: data presentation, complexity of operation, quantity of data, and approach to risk.

PFDs typically display airspeed and altitude as vertical tapes on the screen. Beside the tape is a digital display of the value and the trend (VSI beside the altimeter tape). Those of us who grew up with round dials will feel more comfortable with a single glance at a needle. Human factors experts tell us that the tape is better way of conveying data to humans. I hear the catcalls already.

A digital system requires more button pushing. Many pilots remember fondly the King KX-170B. That radio had eight controls, each of which had only one function. It didn’t matter in which order you manipulated each one. Student pilots often conquered this piece of gear on the first flight. The buttons and
rotary switches on the G1000 change function depending on the order in which you operate them. There is no question that the user interface requires more work. The question is whether it’s worth it.

The modern panel offers information never before available to the pilot. Weather, terrain, traffic, and synthetic vision are four. The G1000 overlays a fuel-exhaustion ring on the moving map, based on current fuel flow. Now the question is whether these contribute to safety, constitute a distraction, or whether they contribute to feelings of invulnerability.

With primary students, I often see TIS-fixation. As soon as the traffic screen pops up, the student begins to obsess about traffic six miles away, often to the detriment of his or her primary flight tasks. As often as I explain it, the student forgets. In most cases there is no possibility of trading paint with a six-mile target for at least ninety seconds. That’s forever in airplane time.

Safety features do not always affect the accident rate in the way we expect. A 2009 DOT study showed that anti-lock braking systems on automobiles had no effect on the fatal accident rate. “ABS has close to a zero net effect on fatal crash involvements.” Despite the finding, I don’t think many of us with ABS in our car or airplane would give it up. ABS did increase the rate of off-road fatalities, which prompted additional study, leading the NHTSA to two additional conclusions: “There was also little evidence that drivers became more aggressive when they had ABS.” It found instead that the increase in the fatality rate was a training problem. The drivers either didn’t know how to use the system, or had unrealistic expectations of it. Training was the answer.

The NTSB’s intent is admirable. It developed six valuable recommendations:

1. enhance pilot knowledge and training requirements;
2. require manufacturers to provide pilots with information to better manage system failures;
3. incorporate training elements regarding electronic primary flight displays into training materials and aeronautical knowledge requirements;
4. incorporate training elements regarding electronic primary flight displays into initial and recurrent flight proficiency requirements for pilots of small light general aviation airplanes equipped with those systems, that address variations in equipment design and operations of such displays;
5. support pilot training programs by developing guidance for the use of glass cockpit simulators other than those that are approved by the FAA as flight training devices; and
6. inform the general aviation community about the importance of reporting malfunctions or defects with electronic flight, navigation and control systems through the Service Difficulty Reporting system.

What remains unclear is whether the data unambiguously indicated that changes are required. After all, the historical fatal accident rate has hovered around 1.25 for the last ten years. The NTSB’s finding of 1.03 for modern glass cockpits looks bad when compared with .43 for steam gauges. It looks pretty good when compared to 1.25, the fleet average for GA.

Everyone has a story to sell, the NTSB included. Nevertheless, the NTSB enjoys a special position as an unbiased analyst of accident data. It should not squander its reputation by cherry-picking data to make a catchy press release. It is disingenuous to highlight a two year sample and deliver it without reference to the long term trends.

Over the next year, we pilots should continue to debate the relative merits of tapes, user interface, more data, and the resulting pilot attitudes. The NTSB should return to the fundamental question: Does the glass cockpit contribute to safety in similar aircraft, in similar weather, and on similar missions?