FLYING BLIND

By Neil Singer

The vast majority of owner/pilots with whom I have worked and flown are fastidious about complying with takeoff limits that relate to runway requirements and certification climb limits. They diligently calculate takeoff performance and accept load and fuel limitations when operating out of short runways or in hot/ high conditions.

Yet most do not use third-party runway analysis services or software to ensure that the equally important requirement of obstacle clearance is respected. Indeed, even pilots who have been operating their jet for many years often may have no sense of what critical information they're missing by flying "blind" when it comes to engine-out obstacle clearance.

Let's first look at what complying with aircraft flight manual (AFM) provided takeoff performance information does provide. First, it ensures the pilot will operate at a weight so that, given the available runway, the pilot can either initiate an aborted takeoff at precisely V1 and stop on the remaining runway, or continue takeoff on one engine to VR then climb to 35 feet above the pavement. Once the aircraft reaches 35 feet (or about half the height of an average maple tree), the plane is then guaranteed to at least meet the certification climb requirements for its category.

Every in-production light jet authorized for single-pilot operation, with the exception of the Eclipse 550, has a maximum takeoff weight of more than 6,000 pounds and is certified under the normal category. The engine-out climb performance required of these jets is spelled out in FAR 23.67: "The steady gradient of climb at an altitude of 400 feet above the takeoff surface must be not less than 2.0 percent." If pilots are aware of this requirement, few make the correlation between this specified gradient and what they would actually experience should an engine fail with the aircraft bumping against the climb-limited take-off weight.

Taking the example of a Citation Mustang or Phenom 100 with a calculated V2 of 100 knots, converting a 2-percent gradient (122 feet of altitude gain per forward nautical mile traveled) into a more understandable rate of climb figure, we see that the pilot may experience as little as 200 feet/minute of climb should the engine fail. A 2-percent slope is really quite shallow, and often the area around what are thought of as flat-land airports requires a steeper climb to maintain terrain separation.

Take the case of McCollum Field, Ga., (KRYY). A class delta satellite of Atlanta with an elevation of 1041 feet, its single Runway 9-27 is 6,311 feet long — long enough that most light jet pilots wouldn't imagine weight could possibly pose issues, even on a hot summer day. Yet just off the departure end of Runway 27 sits a highway embankment cut into a small hill, stretching 350 feet above the runway elevation. It's too wide for a pilot suffering an engine failure to be able to avoid it by turning and too close to the runway end to make a 180-degree turn an option. The gradient needed to clear the embankment is approximately 3.2 percent, or 50 percent greater than a pilot is guaranteed by the climb certification limits.

If a Phenom 100 pilot departing Runway 27 considered only AFM performance data, he/she would calculate that a takeoff at 40 degrees C could be performed at maximum takeoff weight (MTOW). Yet running the problem through runway-analysis software, we see that, in order to clear the terrain, the plane would need to be loaded more than 1,000 pounds below MTOW. The implication of this is frightening: A pilot departing at MTOW who experiences an engine failure at or just after V1 would not be able to avoid hitting the terrain.

Runway analysis neatly takes care of another subtle performance issue often not understood well by pilots — the fact that the physical pavement length of a runway isn't always the amount of runway that is legal to use for performance calculations.

Runways are required to have a 1,000-foot runway safety area (RSA) at the end of the useable surface, which is suitable for reducing the risk of damage to airplanes in the event of undershoot, overshoot or excursion from the runway. Unfortunately, a drop-off and road immediately at the departure end of Runway 27 means this RSA doesn't exist. When this is the case, the FAA reduces the runway available for calculating accelerate-stop distance, called the ASDA, by the amount of RSA not present.

In the case of Runway 27, with essentially no safety area at the departure end, the published ASDA is 5,374 feet, nearly a full 1,000 feet less than the runway length. A pilot not checking the airport facility directory for KRYY would have no way of seeing this ASDA limit and would be led to believe that a loading requiring the full 6,311 feet of pavement for takeoff would be legal. Runway-analysis software "knows" when ASDA is reduced for RSA purposes and will adjust the takeoff weight accordingly.

A final note: Using runway analysis is not always immediately intuitive and in some cases requires careful thought and understanding of how the numbers provided are generated. The main provider of runway analysis to General Aviation operators, Aircraft Performance Group (APG.aero), features some good reference material on its website that should be carefully digested by any pilot before integrating runway analysis into preflight calculations.