Tricks of Light

Learning From Experience
Incident No. 5

Fifth in a series focusing on approach and landing incidents that might have resulted in controlled flight into terrain but for timely warnings by TAWS.

BY DAN GURNEY

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Limited visibility and a pattern of street lights similar to the approach lights that the flight crew expected to see are possible factors in a close encounter with tall buildings that occurred during a nighttime nonprecision approach to an airport in a major metropolitan area.

The incident involved a modern, "heavy" air carrier aircraft that was being flown on a localizer approach in instrument meteorological conditions. Visibility was limited by fog when the crew descended below 600 ft, the minimum descent altitude (MDA). The aircraft was 2.2 nm (4.1 km) from the runway threshold and descending at 600 fpm through 480 ft when the terrain awareness and warning system (TAWS) generated an "OBSTACLE, OBSTACLE, PULL UP" warning.[1] The crew began the escape maneuver within two seconds (Figure 1).

The "obstacle" was several multistory buildings 340 ft high and 1.8 nm (3.3 km) from the runway threshold. The buildings were at the edge of the obstacle-free zone protecting the instrument approach glide path.[2]

The aircraft's flight path on final approach was equivalent to a constant-angle — 2.99-degree — descent that began approximately 1.0 nm (1.8 km) before reaching the final approach fix (FAF), defined by distance from the localizer. The localizer is offset 0.8 nm (1.5 km) beyond the runway's approach threshold. It is possible that the crew began the premature descent based on the EFIS (electronic flight information system) display of distance from a VNAV (vertical navigation) waypoint on the runway threshold that had been entered in the flight management system for a constant-angle approach.

There was no altitude/range table on the approach chart, and there is no indication that the crew used or even had an independently prepared altitude/range table. Without this monitoring guidance, any error in commencing the descent likely would not have been identified during the final approach.

Beyond the FAF, the approach chart provided only one check altitude, at a step-down fix 2.7 nm (5.0 km) from the localizer, about 2.0 nm (3.7 km) from the threshold. Beyond that, the crew was dependent on the protection provided by conducting a missed approach at the MDA or by establishing visual contact with the runway environment.

The author's analysis of the incident, which was reviewed by a select group of aviation professionals including airline pilots, did not establish a likely reason for the aircraft's low approach. Regardless of the cause, the error apparently enabled the crew to gain visual contact with the ground at an earlier point than the conditions normally would have allowed. When the TAWS warning was generated, the aircraft was below the MDA; the crew likely believed that they had the approach lights in sight and continued the approach visually, in the foggy conditions.

It is possible that the crew mistook a pattern of street lights for the approach lights. Near the approach end of the runway are street lights aligned both longitudinally and laterally, resembling the centerline and crossbars of an approach light system. There are also light patterns resembling a PAPI (precision approach path indicator).

Lessons to Be Learned

This incident is believed to be the first "save" by the TAWS obstacle mode. All operators should retrofit this mode in their TAWS equipment or activate the obstacle mode in equipment in which it already is available. The obstacle mode is built into every Honeywell EGPWS; activation of the mode may require a minor modification — a wire-strapping change. The aircraft involved in the incident was the first and, at the time, the only aircraft in the operator's fleet to have been modified with the obstacle mode. The mode is active in the EGPWS equipment in most newly manufactured air carrier aircraft.

When conducting a nonprecision instrument approach, it is essential for the flight crew to identify the correct descent point for the final approach and calculate the required approach timing and vertical speed. Accurate descent rate and airspeed control are required to avoid large deviations in the flight path.

Beware of incorrectly identifying lighting features in low-visibility conditions. Take time to confirm what has been seen, and avoid the tendency to "see" what is expected. Cross-checking the visual scene by the pilot flying and the pilot monitoring is difficult when ground contact is first established. Both pilots could be susceptible to the same perceptual error. It is essential that the monitoring function be based on independent information that can confirm the aircraft's continuing safe flight path below MDA. Altitude/range checks, together with track and airspeed information, are vital elements of a monitoring scan.●

[This series, which began in the July issue of *Aviation Safety World*, is adapted from the author's presentation, "Celebrating TAWS Saves, But Lessons Still to Be Learned," at the 2006 European Aviation Safety Seminar and the 2006 Corporate Aviation Safety Seminar.]

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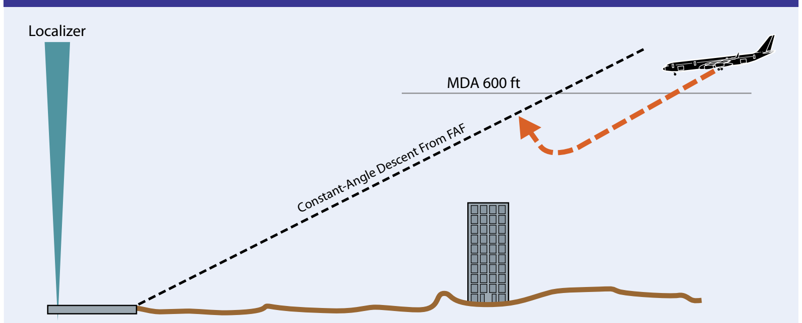
Notes

1. *Terrain awareness and warning system* (*TAWS*) is the term used by the International Civil Aviation Organization to describe ground-proximity warning system (GPWS) equipment that provides predictive terrain-hazard warnings; *enhanced GPWS* (*EGPWS*) and *ground collision avoidance system* (*GCAS*) are other terms used to describe TAWS equipment.

2. U.S. Federal Aviation Administration *Terminal Instrument Procedures*, paragraph 954, "Obstacle Clearance," states, "The transitional surfaces in localizer-only type approaches begin at a height not less than 250 feet below the MDA [minimum descent altitude]."

Aircraft Flight Path



Not to Scale

FAF = Final approach fix   MDA = Minimum descent altitude

Source: Dan Gurney

Figure 1