'Glideslope Unusable'

It took a moment, at a bad time, for the pilots to decipher an unexpected and unusual clearance.

BY MARK LACAGNINA

The Aer Lingus Airbus A330-300 had been airborne more than seven hours since departing from Dublin, Ireland, with 307 passengers and 12 crewmembers. The commander briefed the first officer for the instrument landing system (ILS) approaches to all three active runways at Chicago O'Hare International Airport. As the A330 neared the airport, air traffic control (ATC) issued vectors toward Runway 22R. The aircraft was about 20 nm (37 km) from the runway when the pilots were momentarily confused by a clearance to conduct the "ILS Runway 22R, *glideslope unusable*."

The clearance was "unexpected and unusual," and likely was "the initial destabilizing link in the chain of events" that resulted in the widebody aircraft being flown 774 ft below the correct flight path during the approach, said the final report on the Sept. 16, 2006, incident by the Irish Air Accident Investigation Unit (AAIU).

The commander, the pilot flying (PF), told investigators that he had not heard such a clearance before. Although the pilots decided that it meant they were to conduct a localizer-only approach, the commander said that lingering doubt about the clearance might have affected his performance, which included an error in

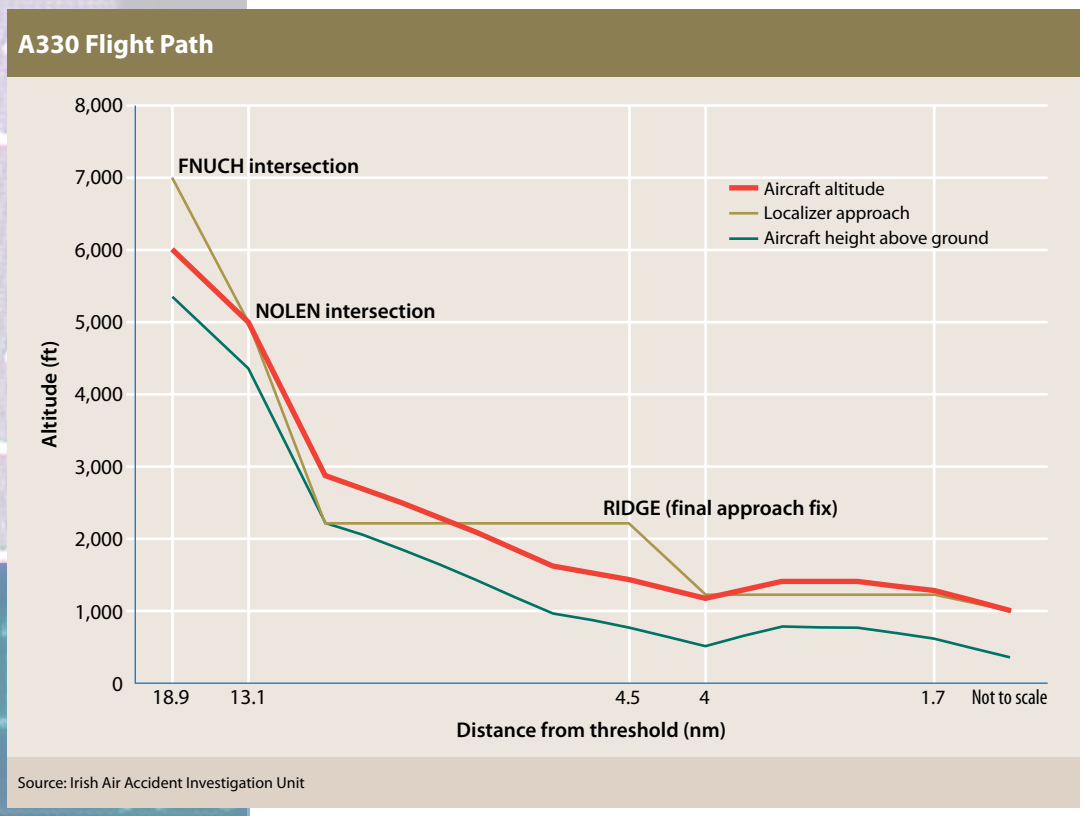

Figure 1

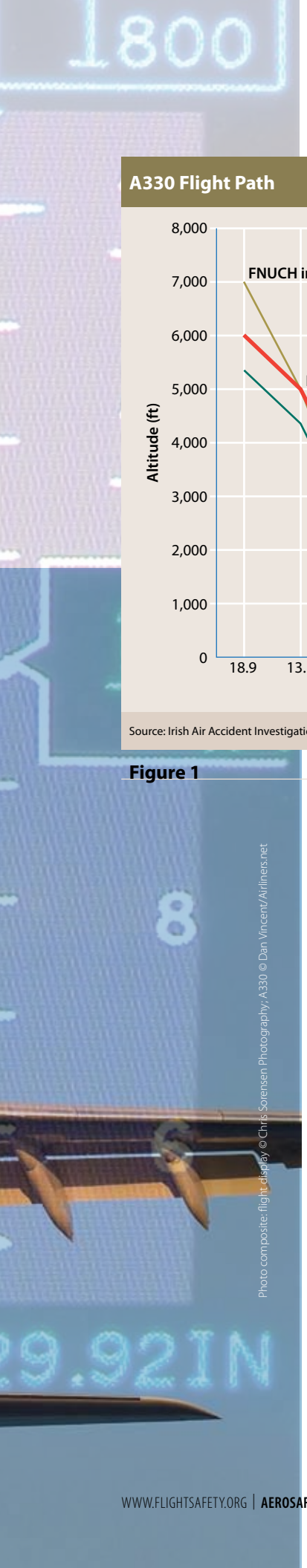

Photo composite: flight display © Chris Sorensen Photography; A330 © Dan Vincent/Airliners.net

mentally calculating the desired descent rate for the nonprecision approach.

The report said that the clearance phraseology *ILS … glideslope unusable* is a contradiction in terms: "The contradiction arises in that an ILS has two elements, a localizer and a glideslope. If either is inoperative, then it is not an ILS."

Air traffic controllers in the United States, however, are required to use that phraseology when the glideslope is out of service or a glideslope signal is being transmitted but either is not reliable for navigation or is not being monitored by ATC. The U.S. Federal Aviation Administration's *Air Traffic Control* manual says, "To require an aircraft to execute a particular instrument approach procedure, specify in the approach clearance the name of the approach as published on the approach chart."

In this case, although the pertinent approach charts published by the U.S. government and by Jeppesen include information for conducting a localizer-only approach, they are titled "ILS RWY 22R."

There is no International Civil Aviation Organization (ICAO) standard. The Irish and U.K. civil aviation authorities also have no published guidance, but ATC officials told investigators that their standard clearance phraseology includes the term *localizer-only*.

"In the JAA/EU [Joint Aviation Authorities/European Union] environment, the investigation has been unable to discover any published ATC clearance phraseology for use for an approach with the glideslope inoperative," the report said. "However, having consulted ATC units in a number of jurisdictions, the investigation has been advised that the same phraseology is used — that is, a clearance for a *localizer* or a *localizer-only* approach."

Scant Time to Prepare

Noting that the glideslope had become unserviceable 20 minutes before the A330 crew received the strange clearance, the report questioned why the pilots had not been advised of the outage sooner. "There should have been adequate time to alert the flight crew in advance of this major change to the approach procedure," the report said. "Late changes in approach procedure are particularly difficult for pilots operating modern-technology aircraft."

The A330 was being flown with the autothrottles and autopilot engaged. The amended clearance required the pilots to reprogram the equipment, and the lateness of the clearance left inadequate time to brief for the approach. "As a result, the flight crew had no pre-shared

understanding or plan regarding the approach procedure," the report said.

In accordance with company standard operating procedures, the flight crew conducted a constant-angle, precision-like approach, rather than following the step-down procedure depicted on the approach chart (*ASW*, 10/07, p. 12). "The method trained by the operator is to use a steady rate of descent from the final approach fix … to arrive at the MDA [minimum descent altitude] at or slightly before the missed approach point," the report said.

The chart that the pilots were using, however, did not provide a distance/altitude table to facilitate the monitoring of a constant-angle localizer approach, and the crew did not have time to prepare their own table.

Airbus A330-300

The twin-engine A330 and the four-engine A340 widebodies were developed simultaneously and share many structural and systems features. Their twin-aisle cabins accommodate as many as 440 passengers. The A330 entered service in January 1994, a few months after the A340.

The A330-300 is the base model; the A330-200 extended-range version, introduced in 1995, has a shorter fuselage and carries fewer passengers. The 300 is equipped with General Electric CF680E1, Pratt & Whitney 4164/4168 or Rolls-Royce Trent 768/772 engines. Maximum weights are 230,000 kg (507,058 lb) for takeoff and 180,000 kg (396,828 lb) for landing. Maximum range with reserves is 4,950 nm (9,167 km).

Source: *Jane's All the World's Aircraft*

The commander mentally calculated the required descent rate for a three-degree glide path but did not account for the runway elevation: 651 ft. Thus, his calculation was incorrect. "The other routes flown by the operator are to airports whose altitudes are close to sea level," the report said. "Therefore, airport altitude is not normally a factor in calculating the height loss required during the approach. This possibly explains why the PF forgot to include runway height in his calculations."

Another possible factor is that the commander initially had been trained to use QFE altimeter procedures and had used the procedures during most of his career. "In a QFE approach, the altimeter indicates the height of the aircraft above the airport, and airport-elevation correction is not required," the report said.

Cockpit Discord

Visual meteorological conditions with good visibility and light winds prevailed at the airport. Due to an altitude assignment by ATC, the aircraft crossed the FNUCH intersection 1,000 ft below the published approach height (Figure 1, p. 27). It then crossed the NOLEN intersection at the published altitude.

Up to this point, the approach was stabilized. Then, realizing that he had made an error in calculating the descent rate and perceiving that the aircraft was too high, the commander selected a steeper glide path angle. He did not tell the first officer about the change, and the first officer was not monitoring the approach when the change was made. The first officer told investigators that he was temporarily "out of the loop" while looking up the ground control frequency on the chart and selecting it as the standby radio frequency.

Recorded flight data monitoring (FDM) data showed that the aircraft descended below the correct flight path after crossing NOLEN and was 774 ft too low when it crossed RIDGE, the final approach fix.

The report said that during this time, the commander likely had been trying to acquire visual contact with the runway and did not perform a cross-check of altitude and distance to go. "As the approach was conducted in the late afternoon in

the autumn [into diffused sunlight], it is probable that the runway approach lights and the airport itself would have been difficult to identify at a distance even though the visibility was probably in excess of 10 miles," the report said.

Indecisive Action

Soon after crossing the final approach fix, the commander realized that the aircraft was too low. The first officer said that he looked up when he heard the commander say that something was wrong. "He saw the runway and the preceding aircraft ahead and knew the picture did not look right," the report said.

The report said that the commander's subsequent actions were indecisive. FDM data showed that maximum continuous power initially was applied and the aircraft leveled off 509 ft above ground level and began a shallow climb; then, takeoff/go-around power was applied and the pitch attitude was increased to a value appropriate for a go-around. The commander told investigators that he believed he called for a go-around, but the first officer did not recall this. "[The commander] stated that if he had not called for a go-around, he had intended to do so," the report said.

As the A330 climbed above the MDA, the first officer suggested that the commander level off. "As they were coming into the normal visual landing slot and the aircraft was still configured for landing, the [commander] made a decision to land," the report said.

After landing, the commander and first officer briefly discussed the approach and decided that they did not have to file a mandatory incident report with the airline. Neither pilot believed that safety had been jeopardized or a height-control error of more than 300 ft had occurred — two conditions requiring a mandatory report. However, the commander filed a confidential report with the airline's safety office that focused on how the late and unusual change to the approach clearance led to the descent rate miscalculation and the poorly flown approach.

The seriousness of the flight path deviation later was discovered during routine analysis of FDM data by the airline. "When [the commander] saw the FDM data, he realized the occurrence should have been formally reported," the report said, noting that the AAIU was informed of the incident almost four months after it happened. "By that time, most records concerning the flight had been discarded, other than the operator's FDM data."

The aircraft's enhanced ground-proximity warning system (EGPWS) had not generated a warning during the approach. "Most [EGPWS] warnings are inactive once landing gear and flaps are extended on a nonprecision instrument approach, with the exception of a Mode 1 'excessive descent rate' warning and a 'terrain clearance floor warning,'" the report said. "The former is triggered by the aircraft descending at too high a rate of descent close to the ground — over twice the rate of descent recorded for the incident aircraft. The latter warning is triggered by a descent below a reducing floor height as the runway is neared; the floor height for the last 12 miles is 400 ft, reducing linearly to zero between 5 nm and the threshold."

Cases of Confusion

The report cited two accidents that occurred after flight crews received an approach clearance with the *ILS … glideslope unusable* phraseology. On Aug. 6, 1997, the first officer of a Korean Air Boeing 747 nearing the airport at Agana, Guam, did not acknowledge that the glideslope was unusable in his readback of the clearance (*Flight Safety Digest*, 5–7/00, p. 5). "Although there was a NOTAM (notice to airmen) published indicating that the glideslope was inoperative and cockpit voice recorder transcripts show that the crew had heard that the glideslope was unusable, its status was commented on a number of times during the approach," the report said. The 747 struck high terrain about 3 nm (6 km) from the airport.

The U.S. National Transportation Safety Board (NTSB) said that the probable cause of the Guam accident was "the captain's failure to adequately brief and execute the nonprecision approach and the first officer's and flight engineer's failure to effectively monitor and cross-check the captain's execution of the approach."

On Feb. 18, 2007, the pilots of a Shuttle America Embraer 170 nearing Cleveland discussed the phraseology after hearing the clearance issued to the crew of a preceding aircraft. "It's not an ILS if there's no glideslope," the captain said. "Exactly," the first officer said. "It's a localizer." The 170 pilots, who received the same clearance, later told investigators that they were confused by the term *unusable*. [This was not considered a factor in the aircraft's subsequent overrun of the snow-covered runway (*ASW*, 9/08, p. 22). NTSB said that the probable cause was the "failure of the flight crew to execute a missed approach when visual cues for the runway were not distinct and identifiable."]

Based on its investigation of the A330 incident at Chicago, the AAIU recommended that standardized clearance phraseology for an approach using only the localizer element of an ILS be developed under the aegis of ICAO. Among other recommendations was that ICAO should require distance/altitude tables to be included on all nonprecision approach charts.

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