TOO TIRED?

PERIL
The serious incident emerged from the aircraft's descent below the stipulated min. altitude.

Michael R. Grüninger and Capt. Carl C. Norgren take a close look at the probable causes of a near-disaster in Denmark, where an incoming SAAB 2000 aircraft descended below minimum safe height

The First Approach

On 10 December 2015, the Saab 2000 turboprop commuter aircraft was established on the CAT I ILS approach to runway 27 into Billund (EKBI), Denmark, when the commander of flight AB 8054 noticed fluctuations on the glide slope indicator. The aircraft was descending to the final approach fix altitude of 2,000 ft AMSL. The autopilot was engaged and the localizer and the glideslope were captured.

The glide slope indicator fluctuated between 'centered' and full-scale 'fly up' indications. The autopilot attempted to follow the erratic movements of the glide slope. The commander disconnected the autopilot and attempted to follow a stabilized descent profile. The erratic indications persisted. The ATC confirmed that the ILS ground equipment was fully operational.

The commander continued the approach. The approach was flown in IMC with a strong and gusty crosswind around 50 Kts on approach causing moderate turbulence. The fluctuations of the glide slope indication continued. At 1,050 ft AMSL (approximately 800 ft AAE) the commander, who was pilot flying on this short sector from Berlin-Tegel (EDDT), initiated a go-around.

The Second Approach

After analyzing the situation, the crew concluded that the erratic glide slope indication was caused by a failure in the on-board equipment. They requested a non-precision localizer only approach. During the subsequent approach briefing the co-pilot, who was pilot monitoring, added that the target rate of descent to achieve a continuous descent approach along the localizer would be 750 ft/minute based on a ground speed of 140 Kts.

ATC provided radar vectors and the aircraft was established on the localizer at 3,000 ft AMSL around 6 miles before the calculated descent point. The aircraft was fully configured and initiated descent shortly before the calculated descent point. The commander selected a rate of descent of 800 ft/min.

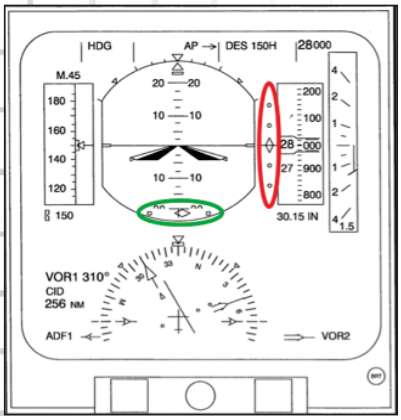
The final approach fix was at 2,000 ft at DME 5.6. At this point, the aircraft was passing an altitude of around 1,300 ft. Shortly after the auto-callout 'one thousand' and 'five hundred' sounded. Seven seconds later, the EGPWS 'terrain ahead, pull up' warning sounded. The commander initiated a 'go-around'.

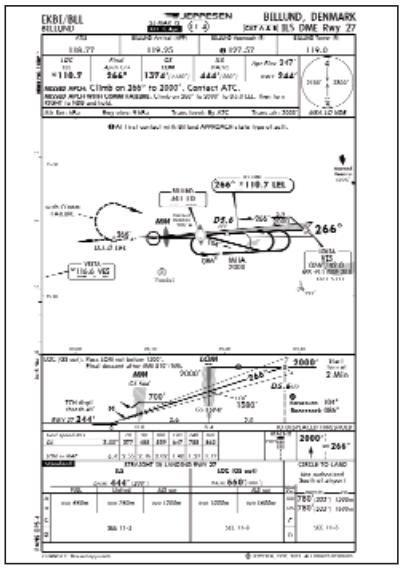
The crew analyzed the situation and concluded that the safest course of action is a return to the departure airport where a VMC approach could be made. The subsequent landing was uneventful.

The Value of EGPWS

A non-precision approach in gusty conditions after a go-around due to an equipment malfunction is demanding.

But how could this sequence of events lead to such a close call? When the EGPWS sounded the aircraft initiated a go-around. The lowest altitude recorded was 700 ft AMSL (346 ft AGL). The EGPWS warning acted as a last line of defense and played a vital





role in saving the lives of 26 passengers and 3 crew on this flight. But which other defense mechanisms failed on this day?

Decision Making

The stabilized approach criteria of the operator require that the aircraft achieve a tracking tolerance of +/- 1 dot deviation after passing 1,000 AAE. With an erratic glide slope indication fluctuating between up to full scale deflection (2.5 dot) the aircraft was not stabilized on the first approach.

Indeed, proceeding past the final approach fix with an unreliable glideslope indication and attempting to perform an ILS approach without a reliable glide slope indication is not an acceptable practice. The flight crew should not have attempted to fly the ILS approach in the first place.

Lack of Monitoring of Vertical Profile

During the second approach, the vertical profile was flown with a 'continuous descent final approach' (CDFA) flight technique. The principle of this method is to maintain a stable, continuous descent rate from the final approach fix to the minimum descent altitude / missed approach point. The goal is to avoid to destabilize the vertical profile with level-offs at each step.

When using the CDFA flight technique the crew must monitor the vertical profile of the aircraft and manually ensure that any altitude steps are complied with. The localizer approach at Billund only has one step that needs to be observed: The outer marker shall be crossed at or above 1,380 ft.

The aircraft descended below this altitude approximately 2.5 nm before the outer marker. Neither pilot flying nor pilot monitoring called for a level-off.

The commander, who was pilot flying, realized that the approach chart did not have a 'recommended altitude descent table' when he initiated the descent. He, therefore, asked the pilot monitoring to 'monitor the vertical profile'.

The pilot monitoring was not able to calculate any reference altitudes based on the ILS DME reading. However, he did not mention this to the commander. In the end, neither pilot was monitoring the vertical profile during the descent.

Controlling the vertical descent profile during a non-precision approach is one of the prime tasks of the pilot flying. By delegating this to the pilot monitoring, the commander effectively changed the work-split on the flight deck. The duties of the pilot flying and the pilot monitoring became blurred and the system of checks and balances between the pilots broke down completely.

The pilot flying no longer performed his prime duties and the pilot monitoring also did not perform his prime duty of monitoring the situation. As a result, nobody was effectively monitoring the aircraft in its vertical profile.

Instead of descending on a 3 degree approach profile, the aircraft descended on a 4.2 degree profile. This was due to the incorrect vertical speed applied. Due to the strong winds the ground speed used for the rate of descent calculation was incorrect. Instead of 140 Kts the aircraft was flying close to 100 Kts ground speed. At this slower ground speed the vertical speed required for a 3 degree profile would have been around 550 ft/min instead of 800 ft/min.

Decision Fatigue

How could such deficient decision making and brake-up of crew resource management happen? The most likely answer lies in the events of the preceding days to the flight.

The airline rescheduled the commander's roster. On the day before the serious incident flight, the commander was originally planned to spend a day off-duty in Berlin. But at the end, he was repositioned to Prague. Given the original crew roster, the commander had already agreed on meeting with some personal acquaintances of his in Berlin. When he learned that he would not be in Berlin as scheduled, he flew from Prague to Berlin and back on the same day as a passenger.

The commander, thus, did not properly rest and did not sleep more than probably 4 to 5 hours prior to the flight of the incident day. The serious incident occurred on the fourth of five planned flights that day. The accident report thus concludes that reduced performance of the pilot flying, probably due to tiredness, was a factor directly contributing to the serious incident.

The report does not mention a reason for the reduced performance of the pilot monitoring for whom the incident flight was the first flight that day after sufficient rest.

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GRAPHIC
The illustration on the left shows the artificial horizon, while the other one is ILS/LOC approach chart for runway 27 at Billund Airport.