

Departing from Douala, Cameroon, on a dark night that was beset by thunderstorms, a Kenya Airways Boeing 737-800 entered a slow right roll that continued for nearly a minute without the flight crew or the autopilot engaged. The captain — the pilot flying — was preoccupied with the weather and had lost situational awareness. The first officer, who had been left out of the loop of the captain’s planning, was not effectively monitoring what was going on, and he did not notice that the autopilot had not been engaged, as intended.

Confusion and spatial disorientation prevailed when a bank angle warning sounded. The captain responded with erratic flight control inputs that aggravated the situation and precipitated a spiral dive. The pilots were wrestling the controls when the 737 disintegrated in a mangrove swamp, killing all 114 people aboard.

A technical commission of inquiry convened by the Republic of Cameroon found that the events leading to the May 5, 2007, accident were fraught with deficiencies in pilot performance that had been brought to light

repeatedly by instructors and examiners at the airline.

Both pilots were Kenyans. The captain, 52, held type ratings in several 737 models, as well as the Airbus A310-300. He had 8,682 flight hours, including 823 hours as a 737 pilot-in-command. The final report by the technical commission of inquiry said that after he received his initial 737 type rating in 1997, “recurring shortcomings” were cited by instructors and examiners. They included deficiencies in crew resource management (CRM), knowledge of airplane systems, adherence to standard operating

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Beyond Redemption

Spatial disorientation turned a minor upset into a major accident.





The accident airplane (left) was on a scheduled flight from the Ivory Coast to Kenya, with an en route stop in Cameroon.

procedures (SOPs), cockpit scanning, situational awareness, planning and decision making. The pilot's performance was found to be unsatisfactory during some proficiency checks, and he was required to receive extra training before another check was administered.

A proficiency check in 2002 was converted to a training flight after the captain demonstrated inadequate knowledge of systems and procedures. During recurrent training in 2003, an instructor urged him to be more attentive to checklists and aircraft limitations, be more systematic in responding to system failures, provide more consistent briefings and adhere to SOPs. A 2004 training session resulted in recommendations that he take time to analyze system failures and to discuss them with the first officer. A 2005 line proficiency check cited deficiencies in the captain's command ability and teamwork, and his familiarity with airplane systems and SOPs; the examiner also noted

that he tended to be "overbearing." A 2006 line check found the captain's performance below standard and required that he undergo another line check; the training manager told the examiner to determine if "complacency or incompetence is the issue." The captain passed the second line check, and "there was no evidence of any retraining or punitive action taken against him," the report said. An examiner's report on a proficiency check three months before the accident contained no comments.

Kenya Airways evaluated pilot performance as "not acceptable," "acceptable," "standard" (average) or "above standard." The captain's performance consistently was judged as acceptable.

The first officer, 23, had 831 flight hours, including 170 hours in type. Performance assessments issued during his training as a 737 first officer cited requirements for improvement in situational awareness, radio communications, monitoring the pilot flying and calling out deviations. "However, his overall performance during training and flight checks was judged to be satisfactory," the report said. He earned a 737 second-in-command type rating in September 2006.

The report said that Kenya Airways should have avoided pairing the pilots for flight duty because of the deficiencies observed during training and evaluation, and because of known psychological traits. The captain was described as having a strong character and a heightened ego, and was known to be authoritative and domineering with subordinates. "He seems to have been affected by the slow progress of his career and the fact that he had remained on the 737," the report said. His attitude toward the first officer during the accident flight was described as "paternalistic."

In contrast, the first officer was known to be reserved and nonassertive. The report said that during the accident flight, he appeared to be "intimidated by the meteorological situation" and "subdued by the strong personality of the captain."

'Disquieting Conditions'

The accident occurred during a scheduled flight, KQA 507, from Abidjan, Ivory Coast, to Nairobi, Kenya, with a one-hour stop at Douala, on the



conditions beyond the runway. The departure clearance required that they maintain runway heading during the initial climb, and they agreed that a deviation south of the assigned course would avoid the largest cells. The captain told the controller, “After departure, we would like to maintain slightly left of runway heading due to weather ahead.” The first officer corrected the captain, who then

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Neither pilot noticed that the autopilot did not engage when the “CMD” (command) push button, on the right side of the mode control panel at the top this photo, was pressed.

fifth day of the crew’s five-day pairing. The 737 landed in Douala on schedule at 2201 local time, but the crew was told by the airport traffic controller to taxi to a terminal gate that was different from the one at which the ground crew was waiting. That miscue, plus the captain’s decision to postpone engine start until heavy rain abated, delayed the departure about one hour.

The report said that before leaving the gate shortly after midnight, the captain did not conduct a departure briefing, which was required especially in light of the “rather disquieting meteorological conditions.” When he called for the “Before Taxi” checklist, the first officer began conducting the “Before Takeoff” checklist; the captain did not correct him.

Weather conditions were influenced by thunderstorm activity that had begun in the afternoon and was forecast to last until morning. A storm had passed over the airport while the 737 was parked at the gate, and there were storms in the vicinity of the airport. When the crew taxied onto Runway 12 for takeoff, visibility was 800 m (1/2 mi) in rain, and surface winds were from 050 at 10 kt, gusting to 20 kt.

While holding for takeoff, the pilots used the on-board weather radar to analyze the

radioed, “Sorry, slightly right.” The controller approved the request.

The captain, the pilot flying, then initiated the takeoff although neither he nor the first officer had requested or received clearance from the controller. The flight directors and autothrottle were engaged in the takeoff/go-around mode, with a selected heading of 118 degrees and a selected climb speed of 150 kt. The airplane lifted off at 0006.

Tendency to Roll Right

The report said that the airplane had a tendency to roll right likely because of a slight mispositioning of the rudder trim control and/or because of an inherent trim asymmetry that resulted during its construction in 2006.¹ The captain used his control wheel to counter the roll tendency until the selected heading was changed from 118 degrees to 139 degrees as the airplane climbed through 1,000 ft. He told the first officer, “I will keep somewhere around here.” About this time, all action on the flight controls ceased, the report said, noting that the crew’s attention likely was focused on using the weather radar to avoid thunderstorms.

The airplane was banked 11 degrees right, turning through a heading of 127 degrees and climbing through 1,600 ft when climb power was selected and the captain said, “OK, command.” This was a reference to engagement of the autopilot, which, according to company SOPs, is accomplished and called out by the pilot flying and cross-checked by the pilot monitoring. However, the first officer said nothing in response to the captain’s callout, and neither pilot noticed that the flight mode annunciator indicated that the autopilot was not engaged.

Recorded flight data showed that the “CMD” (command) push button on the mode control panel had indeed been pressed to engage the autopilot, but the report said that the autopilot likely failed to engage because forward pressure was being applied manually to a control column at the same time. The report said that the captain’s subsequent behavior indicated that he believed the autopilot was engaged and that trim inputs effected by the autothrottle in response to excessive airspeed changes might have reinforced that impression.

The airplane was climbing through 2,400 ft when the air traffic controller issued a new altimeter setting. “The two pilots executed the change of altimeter setting without noticing or interpreting the deteriorating flight parameters that were clearly visible on the EADI [electronic attitude director indicator], on which, incidentally, they were reading the altimeter setting,” the report said.

As the airplane turned through the selected heading, 139 degrees, the flight director roll-command bars moved left. The selected heading was changed to 120 degrees, but the airplane continued turning right, now with a 20-degree bank angle. The 737 was turning through 190 degrees and climbing

through 2,600 ft when the first officer asked, “I continue with heading?” The captain did not respond, but the selected heading was changed from 120 degrees to 165 degrees.

‘We Are Crashing’

At 0007:19, the captain uttered an expression of surprise when the enhanced ground-proximity warning system generated an aural warning: “bank angle.” A flight simulation later conducted by Boeing showed that the airplane easily could have been returned to wings-level flight without excessive control inputs at this point — *if* the pilot flying was not spatially disoriented. However, the report said that the captain responded with control inputs that were “erratic.” He moved the control wheel 22 degrees right, 20 degrees left, 45 degrees right and then 11 degrees left.

The airplane was banked 50 degrees right and was climbing through 2,770 ft at 0007:23, when the captain again attempted to engage the autopilot by pressing the “CMD” button on the mode control panel. However, because the flight director roll-command bars were more than one-half scale from center, the autopilot engaged in the control wheel steering mode. Thus, the autopilot did not respond to the selected flight modes; its sole input was to reduce the bank angle to 30 degrees.

The report said that the captain apparently did not understand the airplane’s reaction to the engagement of the autopilot; he resumed his “confused and intense” movement of the flight controls and applied “several bursts” of right rudder.

At 0007:28, the captain said, “We are crashing.” The first officer agreed: “Right, yeah, we are crashing.”

The airplane was at 2,900 ft and banked 90 degrees right at 0007:31,

when it entered a rapid spiral dive that was precipitated by the captain’s rudder inputs. The first officer apparently recognized what needed to be done to recover but mistakenly called, “Right, captain.” He then corrected himself, exclaiming, “Left, left, left ... correction, left.”

At this point, the pilots made conflicting control movements. The first officer tried to roll left and lower the nose while the captain held full right roll and nose-up pitch control. “The first officer’s action was corrective, while the captain’s action was aggravating, but the situation was already beyond redemption,” the report said.

The 737 was in a 60-degree right bank and a 48-degree nose-down pitch attitude, and descending at 14,000 fpm with an airspeed of 287 kt, when it struck terrain at 0007:42. The emergency locator transmitter was damaged on impact and did not emit a usable signal; the wreckage was not found until 1730.

Among the recommendations generated by the accident investigation was that all pilots should receive formal upset recovery training. 🌀

This article is based on the technical commission of inquiry’s report, “Technical Investigation Into the Accident of the B737-800 Registration 5Y-KYA Operated by Kenya Airways That Occurred on the 5th of May 2007 in Douala.” The full report is available at <www.ccaa.aero/surete-et-securite-aerienne-141>.

Note

1. The report also discussed the little-known phenomenon of *thermal effect*, which can cause a rudder to deflect left when the airplane encounters colder air, as during climb, or to deflect right when the air becomes warmer, as during descent. Maximum rudder deflection that can be caused by thermal effect is 0.75 degrees, the report said.