Comair Flight 5191 Accident Analysis

Posted on October 11, 2019

The Accident in Brief

At 6:06 a.m. on August 27, 2006, Comair Flight 5191 began its takeoff roll at Blue Grass Airport in Lexington, Kentucky. The Bombardier CRJ-100 was scheduled to fly to Atlanta with 47 passengers and three crew members. Air traffic control had cleared the flight for departure from Runway 22, the airport's 7,003-foot primary runway. Instead, the aircraft turned onto Runway 26, an unlighted general-aviation runway only 3,501 feet long. (Hollnagel et al., 2008; National Transportation Safety Board, 2007)

The pilots applied takeoff power and continued accelerating. The aircraft passed the end of the pavement without reaching safe flying speed, crossed uneven ground, became briefly airborne, and struck an earthen berm and trees. A severe post-crash fire followed. Forty-nine of the 50 people on board died. The first officer survived with critical injuries.

The National Transportation Safety Board did not describe the crash as the result of one mysterious mechanical failure. It identified failures by the flight crew to determine the aircraft's position during taxi and to verify that the correct runway had been entered before takeoff. The investigation also examined airport construction, lighting, chart information, cockpit conversation, air-traffic-control performance, fatigue, and the absence of technologies that could have warned the crew. The accident is therefore a strong example of why aviation safety is studied as a system. The crew's final error mattered, but the conditions surrounding that error explain why it was not detected in time.

From Gate to Wrong Runway: Reconstructing the Sequence

The flight was operating before sunrise. Blue Grass Airport was undergoing a construction project that had changed portions of the taxiway system. The airport had issued notices and markings, and the crew possessed information about the changes, but the altered environment increased the need for careful positional awareness.

The controller instructed Flight 5191 to taxi to Runway 22. The captain acknowledged the clearance, and the crew set heading references consistent with Runway 22. They had several cues pointing toward the intended runway: the clearance itself, the heading, the airport diagram, signs, markings, and the fact that Runway 22 had lighting appropriate for the early-morning departure.

During taxi, however, the aircraft passed the turn that would have aligned it with Runway 22 and entered Runway 26. The cockpit voice recorder captured conversation unrelated to the immediate operation during a period when sterile-cockpit discipline should have limited discussion to essential duties. Such conversation did not physically move the aircraft onto the wrong runway, but it consumed attention at a time when the crew needed to interpret an unfamiliar taxi environment.

Once on Runway 26, the pilots noticed something was unusual. The first officer made comments concerning the absence of lights. Those remarks should have triggered a complete stop and verification. Instead, the crew continued. The takeoff checklist, heading confirmation, and runway identification did not produce an effective challenge.

The air traffic controller had cleared the aircraft for takeoff and then turned attention to administrative duties. The controller was not required by the procedures then in effect to maintain continuous visual observation of the aircraft through departure, and the control tower did not have an airport-surface detection system capable of automatically warning that the aircraft had entered the wrong runway. The accident occurred before a final external barrier interrupted the crew's mistake.

The NTSB's Probable-Cause Finding

The NTSB determined that the probable cause was the flight crew members' failure to use available cues and aids to identify the airplane's location on the airport surface during taxi and their failure to cross-check and verify that the airplane was on the correct runway before takeoff. The Board identified the pilots' nonpertinent conversation during taxi as a contributing factor.

This wording is important. The investigation did not say simply that the pilots were confused or tired. It identified specific tasks that were not completed reliably: maintaining position awareness, recognizing cues, cross-checking, and verifying the runway. Safety recommendations can be developed only when a general label such as "human error" is translated into observable failures.

The finding also avoids the claim in the original essay that a "happy crew" caused poor coordination. Mood was not the central issue. The relevant human-factors concerns were attention, cockpit discipline, expectation, confirmation, workload, and crew-resource management.

Expectation and Confirmation Bias

People do not perceive an environment as neutral observers. They interpret what they see through expectations. The pilots expected to reach Runway 22. Once they believed they had arrived there, ambiguous cues may have been interpreted as consistent with that belief. The heading bug had been set correctly, but it did not help if the crew did not compare the actual aircraft heading with the expected runway heading before initiating takeoff.

Confirmation bias can cause a person to notice evidence supporting an assumption while explaining away contradictory evidence. The missing runway lights were a contradiction. The short visual perspective was another. A robust cockpit procedure should force the crew to state and compare the runway designation and magnetic heading aloud so that expectation is tested rather than shared silently.

Both pilots can hold the same mistaken mental model. Crew-resource management is sometimes misunderstood as one pilot correcting another. Its deeper purpose is to create structured checks that reveal error even when both professionals are experienced and confident.

The Sterile Cockpit Rule and Divided Attention

Federal regulations prohibit nonessential activities and conversation during critical phases of flight, including taxi. The rule reflects the fact that attention is limited. A conversation does not need to be intense or emotionally distracting to interfere with monitoring. It can delay a checklist item, interrupt a mental calculation, or make a sign less likely to be noticed.

In Flight 5191, nonpertinent conversation occurred while the crew taxied through a changed airport layout. The lesson is not that pilots must remain silent from boarding to landing. It is that operational transitions—pushback, taxi, runway crossing, takeoff, approach, and landing—require protected attention.

Airlines should reinforce the sterile-cockpit rule through training and culture, but discipline cannot depend only on fear of punishment. Crews need clear cues for when sterile procedures begin, permission to interrupt unrelated conversation, and leadership from the captain. Audits and line-oriented safety programs can identify whether informal norms undermine the written rule.

Fatigue: Plausible Concern, Limited Finding

The pilots' sleep and duty histories were examined because fatigue can impair vigilance, reaction time, memory, and judgment. Early-morning operations occur during a period when human alertness may be reduced. The captain and first officer had opportunities for sleep that were not necessarily ideal, and the surviving first officer's condition limited some direct evidence.

It is reasonable to discuss fatigue as a possible performance influence, but it should not be presented as the established probable cause when the NTSB did not reach that conclusion. Accident analysis must separate a factor that could increase vulnerability from one demonstrated sufficiently to appear in the probable-cause statement.

The broader recommendation remains valid: airlines need fatigue-risk management that considers circadian timing, commuting, rest opportunities, schedule changes, and cumulative workload. Simply telling crews to arrive rested ignores the degree to which organizations design duty patterns.

Airport Construction and Visual Cues

The airport was not operating under its normal layout. Construction can temporarily change taxi routes, markings, signs, barricades, lighting, and the meaning of familiar visual patterns. Pilots who have used an airport previously may be particularly vulnerable because memory of the old layout competes with current information.

The NTSB examined whether construction-related information and signage provided sufficient cues. The airport had issued notices, and the wrong-runway turn still required crew error, but the changed environment formed part of the operational context. Construction safety should be treated as a temporary high-risk system rather than routine maintenance.

Airports can reduce risk by using conspicuous markings, illuminated signs, standardized barricades, current diagrams, direct communication with operators, and formal review of taxi complexity. Changes should be evaluated during darkness and poor visibility, not only in daylight. When a temporary layout creates an unusual turn or intersection, the question should be whether a crew unfamiliar with the construction can interpret it correctly under workload.

Runway Lighting and the Missed Warning

Runway 22 had lights; Runway 26 did not have the same illuminated appearance expected for the departure. The crew noticed the absence but did not stop. This is an example of a weak warning: the cue existed, but the system did not require a decisive response to it.

Procedures should treat an unexpected dark runway, heading mismatch, or uncertain sign as a stop condition. Continuing slowly while attempting to “figure it out” may be suitable during some taxi situations, but beginning a takeoff with unresolved runway identity is not. A rejected takeoff before power application creates delay and embarrassment; continuing on the wrong runway creates catastrophic risk.

Training can use scenarios in which the correct action is to stop, ask air traffic control, and accept the operational delay. Pilots need to experience that conservative choice as professional judgment rather than failure.

The Controller’s Role and Tower Staffing

One controller was performing tower and radar responsibilities that morning. The FAA’s internal staffing guidance had contemplated separate controllers for certain functions, although the NTSB did not make controller staffing the probable cause of the crash. The controller issued the correct runway clearance. He did not direct the aircraft onto Runway 26.

Still, safety analysis asks whether another barrier could have caught the error. Continuous observation, an alert from surface-surveillance equipment, or a procedural requirement to confirm runway entry might have provided that barrier. Air traffic control should not be expected to compensate for every cockpit error, but overlapping defenses are a basic feature of high-reliability systems.

The controller was also performing an administrative task after issuing takeoff clearance. Procedures and workload should be designed so that safety-critical monitoring is not displaced by paperwork at the wrong moment. Automation can assist, but responsibility for alert design, false alarms, training, and coverage remains important.

Technology That Could Prevent Wrong-Runway Takeoffs

Following wrong-runway and runway-incursion events, aviation authorities and manufacturers have developed several layers of technology. Airport surface-detection systems can track aircraft and vehicles and generate conflict alerts at equipped airports. Runway-status lights can warn pilots when a runway is unsafe to enter or use. Electronic flight bags can display own-ship position on an airport moving map.

Cockpit systems can also compare aircraft position and heading with the expected runway and provide an alert such as “on runway” or “approaching runway.” Technology is especially valuable when it provides an independent check rather than merely repeating information the crew has already misinterpreted.

No technology should be presented as infallible. Databases require updates, sensors can fail, and alerts can be ignored if they occur too often. The purpose is defense in depth: when attention, expectation, and procedure fail together, another system still has a chance to stop the sequence.

A Systems Interpretation

James Reason’s “Swiss cheese” model is useful for understanding Flight 5191. In this model, accidents occur when weaknesses in several defensive layers align. The layers in this case included airport information and layout, cockpit attention, taxi monitoring, sterile-cockpit discipline, runway-heading verification, controller observation, and available warning technology. (Reason, 1997)

The crew’s decision to begin takeoff on Runway 26 was the immediate unsafe act. Yet replacing the pilots with another competent crew would not guarantee that the system could never produce the same error. Prevention requires strengthening the layers: simpler surface design, better alerts, reliable checklist behavior, protected attention, and active monitoring.

A systems approach is not an attempt to excuse professionals. Accountability and systems learning can coexist. The crew was responsible for runway verification. The aviation system was responsible for learning why that verification failed and for reducing the chance that another crew could make an identical fatal error.

Recommendations

Airlines should require an explicit verbal runway-and-heading cross-check immediately before takeoff. Both pilots should independently confirm the runway designation using signs, heading, chart, and available position displays. Any disagreement or uncertainty should require stopping.

Sterile-cockpit procedures should be reinforced through scenario-based training and line observation. Training should include construction layouts, wrong-runway traps, nighttime operations, and the social pressure that can make a pilot reluctant to admit uncertainty.

Airports should perform formal risk assessments during construction and temporary taxiway changes. Signs, markings, lighting, notices, and diagrams should be evaluated from the cockpit perspective at relevant times of day.

The FAA and airport operators should continue deploying surface-surveillance and runway-alert technologies according to risk. Smaller airports may not receive the most expensive systems, so scalable tools—moving-map displays, cockpit alerts, enhanced signage, and procedural barriers—remain necessary.

Fatigue management should consider schedules and circadian timing rather than relying entirely on individual self-management. Tower staffing and administrative workload should also preserve attention during active aircraft movements.

Conclusion

Comair Flight 5191 crashed because a flight cleared for Runway 22 attempted to depart from Runway 26. The error appears simple only after the event. Before the crash, it passed through multiple opportunities for detection: taxi signs, the airport diagram, heading, lighting, cockpit cross-checks, controller observation, and technology.

The accident demonstrates why aviation safety cannot stop at the statement that pilots made a mistake. The useful questions are how two trained crew members shared the same false belief, why contradictory cues did not interrupt it, and which independent defenses were absent or ineffective. The strongest memorial to the 49 people who died is not a promise that professionals will be more careful. It is a system designed so that uncertainty causes a stop, wrong-runway entry creates an unmistakable warning, and one human error does not become the final decision.

References

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