



May 6, 2026

Aviation Investigation Report AIR-26-03

Develop Realistic Scenario-Based Simulated Training for Smoke in the Cockpit Events

Introduction

The National Transportation Safety Board (NTSB) is providing the following information to urge the Federal Aviation Administration (FAA), Airlines for America (A4A), and the Regional Airline Association (RAA) to act on safety recommendations in this report. These recommendations address the lack of training for flight crews in how to manage the stress associated with increased workload, difficulty seeing, and other effects of a cockpit smoke event. Lack of preparation for such an event can impede the continued safe operation of the airplane. We identified this issue during our investigation of a December 20, 2023, incident involving Southwest Airlines flight 554, a Boeing 737-8, in which smoke filled the cockpit after a bird was ingested into the left (No. 1) engine. The NTSB is issuing two safety recommendations to the FAA and one safety recommendation to A4A and the RAA.

Background and Analysis

On December 20, 2023, about 1414 central standard time, Southwest Airlines flight 554, a Boeing 737-8, was departing from Louis Armstrong New Orleans International Airport (MSY), Kenner, Louisiana, when a bird was ingested into the left (No. 1) engine during the initial climb.¹ The flight crew reported that, after an uneventful takeoff and while climbing through about 1,000 ft, the first officer (FO), who was the pilot monitoring, heard the captain say “bird.” This statement was followed immediately by a “thump” on the left side of the airplane. The flight crew reported that the airplane began to “shake violently with a distinct loss of thrust” in the No. 1 engine.

The captain called for the Engine Fire or Engine Severe Damage or Separation checklist in the Quick Reference Card (QRC). After the FO started the checklist, the flight deck filled with “acrid white smoke”; the FO later stated that he could not clearly see the captain. The FO called out “masks,” and the pilots donned their masks and resumed the checklist.

¹ Visit [ntsb.gov](https://www.ntsb.gov) to find additional information for this NTSB investigation (case number [DCA24LA330](https://www.ntsb.gov/investigation.aspx?caseid=DCA24LA330)). Use the [CAROL Query](#) to search safety recommendations and investigations.

The flight crew declared an emergency to air traffic control and asked airport rescue and firefighting to “roll the trucks.” The captain stated that visibility in the cockpit was restricted and that he could see nothing beyond the FO. The captain also stated that his instrument panel was difficult to see, so he thought he might need to fly the airplane solely using the head-up guidance system.² However, after the FO pulled the engine fire switch as directed by the QRC, the smoke began to rapidly dissipate.

The flight crew notified the flight attendants about the emergency and made a public address announcement to passengers that fire trucks would be meeting the airplane. After landing at MSY, the airplane came to a full stop on the arrival runway. After inspecting the airplane, the firefighters found no evidence of a fire. The flight crew was cleared to taxi to the assigned gate and passengers deplaned normally without further incident. None of the 139 occupants aboard the airplane were injured, and the airplane sustained minor damage. The flight was operating under the provisions of Title 14 *Code of Federal Regulations (CFR)* Part 121 as a scheduled domestic passenger flight from MSY to Tampa International Airport, Tampa, Florida.³

During postincident interviews, the flight crew estimated that the cockpit was full of smoke within 5 seconds of its appearance and, as a result, they had difficulty seeing the flight instrument displays. They reported that the annual training they had previously completed was not representative of the challenges associated with smoke filling the cockpit. Referencing his previous smoke training, the captain stated that discussing the “impacts of stress and the surprise factor and the adrenaline” in a briefing or training room did not adequately prepare him for the actual event. He further said that “the initial surprise...and the adrenaline...was...the biggest surprise out of the whole thing.”

Although the crew in this incident was experienced and the incident occurred during day visual meteorological conditions, the captain (who was a check pilot) stated during his interview that had this incident “occurred at nighttime or if we had

² The head-up guidance system is only on the captain’s side of the cockpit but contains all necessary information to fly the airplane. If the pilot flying cannot see the instrumentation due to smoke, the head-up guidance system may be the only source of information.

³ According to the regulations requiring immediate reporting to the NTSB (at Title 49 *CFR* 830.5(a), Immediate notification), Southwest Airlines was not required to report the incident. Once informed by the FAA in November 2024 about its ongoing investigation, the NTSB began an incident investigation. Among the events requiring immediate NTSB notification is “failure of any internal turbine engine component that results in the escape of debris other than out the exhaust path.” Since this incident involved engine oil (which caused smoke) and not debris, it did not meet this notification requirement. Another criterion for reporting is “in-flight fire,” but no fire was involved in this event, only smoke.

been in weather, I think it would have been extremely challenging.”⁴ The NTSB notes that reaction time dealing with an emergency involving smoke in the cockpit during takeoff is even more crucial because this is a high-workload phase of flight and the airplane is at a low altitude. If pilots’ visibility is obscured due to smoke in the cockpit, catastrophic outcomes could result.

On January 6, 1994, the FAA issued Advisory Circular (AC) 25-9A, “Smoke Detection, Penetration, and Evacuation Tests and Related Flight Manual Emergency Procedures.” Section 7d(1), “On-board smoke sources,” provided several reasons smoke or fire may occur, including “failure of electrical equipment (shorted wires)” and noted that “[i]ncidents of on-board fire (excluding engine fires) are extremely rare but they do occur and can compromise safety.”⁵ Since the issuance of this AC more than 30 years ago, airplane manufacturers have continued to increase the amount of electrical equipment on board airplanes, increasing the need for risk mitigation for smoke in the cockpit events. This is further demonstrated by the nearly daily notifications (and sometimes multiple daily notifications) to the FAA concerning flights for which an emergency was declared due to smoke in the cockpit.

There is also currently no requirement in 14 *CFR* Part 121 Appendix F “Proficiency Check Requirements” for training of flight crews to experience a simulated smoke in the cockpit event. The extent of any existing training that flight crews may receive is up to the instructor during recurrent annual training. At the instructor’s discretion, a smoke scenario may or may not be included in this training. If a smoke scenario is included, smoke is not simulated; the instructor would simply state that the cockpit is now filling with smoke and the flight crew would react accordingly.

Further, FAA regulations require evacuation of cockpit smoke within 90 seconds after emergency procedures are initiated. The visual challenges associated with the presence of smoke could delay a flight crew’s performance of emergency checklist items to evacuate it. It could, in fact, take a significant portion of those 90 seconds for the crew to begin the emergency procedure due to decreased visibility, exposing the crew and passengers to potentially dangerous amounts of smoke. The flight crew involved in the Southwest incident noted the challenge they

⁴ The duties of a check pilot are detailed in 14 *CFR* Part 121.411 Qualifications: Check pilots and check flight engineers.

⁵ Other reasons listed in the AC included “...overheating of equipment (loss of thermostats or controlling devices), leakage of hot air from pneumatic ducts or spillage of combustible fluid (hydraulic oil, glycol) on a hot surface.”

had in seeing various switches, lights, and flight instruments as smoke filled the cockpit.⁶

The NTSB is aware of equipment options to enhance pilots' training in this area; for example, wearable smoke lenses are available that simulate various levels of reduced visibility from light to dark. The NTSB obtained lens samples (from a company that supplies them to firefighting agencies) that fit inside a self-contained breathing apparatus mask and used them during simulator testing conducted with representatives from the FAA, Southwest Airlines Pilots Association, and Boeing.⁷ The lenses provided the evaluators with a better understanding of workload during a smoke-in-the-cockpit event, including the effects of smoke while performing checklist procedures to evacuate it.

There are some simulators that use smoke generators to produce active smoke-in-the-cockpit simulations; however, when using such a smoke generator, the simulator's fire alarm system must be placed into bypass mode or the smoke generator's product will trigger it. Simulators that currently have a smoke generator are the Falcon 900/2000, Falcon 7X, Global Express, Global Vision, KingAir 350, and the CL3500.

The NTSB is aware of another option that uses augmented reality to provide a see-through display inside the oxygen mask, allowing pilots to safely navigate and land during an emergency.^{8,9} FedEx is currently working with the manufacturer to install this technology in 777s to test it, and they are also developing it for the 767, G550, and G450, with the 757, G280, and Bombardier 6000 and 7500 in the queue.

The NTSB concludes that the lack of realistic scenario-based training for smoke in the cockpit events may prevent flight crews that carry passengers for hire from responding quickly during an actual smoke emergency, potentially increasing the time it takes to evacuate the smoke. The NTSB therefore recommends that the FAA work with the industry to develop standardized training for realistic scenario-based simulations of smoke-in-the-cockpit events to be used during initial and recurrent pilot training for all operators that carry passengers for hire.

⁶ FAA [AC 25-9A - Smoke Detection, Penetration, and Evacuation Tests and Related Flight Manual Emergency Procedures](#) section 12a, "Smoke Evacuation Tests, Background" states, "Typical commercial large transport airplanes are capable of evacuating dense cockpit smoke within approximately 90 seconds after the AFM fire and smoke emergency procedures are initiated."

⁷ [Smoke Simulation Evaluation Report](#)

⁸ The information within this Safety Recommendation Report regarding private sector websites, products, or services is provided for informational purposes only and does not constitute an official endorsement or approval of any private sector website, product, or service by the NTSB or the federal government.

⁹ [SAVED - Klatt Works, Inc.](#)

For oversight of operators' training standards, FAA principal operations inspectors refer to FAA Order 8900.1A, "Flight Standards Information Management System, Volume 3 General Technical Administration," Chapter 19 Training Programs and Airman Qualifications. To ensure the training requested in A-26-58 is captured in the oversight of operators' required training, the NTSB recommends that the FAA incorporate the training into FAA Order 8900.1A, Flight Standards Information Management System, Volume 3 "General Technical Administration," Chapter 19 "Training Programs and Airman Qualifications."

After the incident in Kenner, Louisiana, Southwest Airlines informed its pilots of the circumstances of the incident and warned them of the potential for smoke in the cockpit in similar circumstances. The NTSB feels that the potential for other operators to experience such an incident warrants broader notification. Therefore, the NTSB further recommends that A4A and the RAA disseminate the information and findings from the December 20, 2023, Kenner, Louisiana, incident to their members and encourage them to incorporate realistic, scenario-based training to simulate smoke in the cockpit events.

Conclusions

Findings

The lack of realistic scenario-based training for smoke in the cockpit events may prevent flight crews that carry passengers for hire from responding quickly during an actual smoke emergency, potentially increasing the time it takes to evacuate the smoke.

Recommendations

New Recommendations

As a result of this investigation, the National Transportation Safety Board makes the following new safety recommendations.

To the Federal Aviation Administration (FAA):

Work with the industry to develop standardized training for realistic scenario-based simulations of smoke in the cockpit events to be used during initial and recurrent pilot training for all operators that carry passengers for hire. (A-26-58)

After the standardized realistic scenario-based simulations are developed, as requested in A-26-58, incorporate the training into FAA Order 8900.1A, Flight Standards Information Management System, Volume 3 "General Technical Administration," Chapter 19 "Training Programs and Airman Qualifications." (A-26-59)

To Airlines for America (A4A) and the Regional Airline Association (RAA):

Disseminate the information and findings from the December 20, 2023, Kenner, Louisiana, incident to your members and encourage them to incorporate realistic, scenario-based training to simulate smoke in the cockpit events. (A-26-60)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

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