NATIONAL TRANSPORTATION SAFETY BOARD
(Information subject to editing)

Runway Incursion and Rejected Takeoff
American Airlines Flight 106, Boeing 777-200, N754AN, and
Delta Air Lines Flight 1943, Boeing 737-900, N914DU
Queens, New York
January 13, 2023
DCA23LA125

This is a synopsis from the NTSB's report and does not include the Board's rationale for the findings, probable cause, and safety recommendations. NTSB staff is currently making final revisions to the report from which the attached findings and safety recommendations have been extracted. The final report and pertinent safety recommendation letters will be distributed to recommendation recipients as soon as possible. The attached information is subject to further review and editing.

Executive Summary

What Happened

On January 13, 2023, about 2044 local time, American Airlines (AAL) flight 106 crossed runway 4L on taxiway J without air traffic control (ATC) clearance at John F. Kennedy International Airport (JFK), causing Delta Air Lines (DAL) flight 1943 to abort its takeoff roll on runway 4L. None of the 159 passengers and crew members onboard DAL1943, nor the 149 passengers and crew onboard AAL106, were injured. Dark night visual meteorological conditions were present the night of the incident.

The flight crew of AAL106 were instructed to taxi to runway 4L for departure and to cross runway 31L while enroute to runway 4L; however, rather than turning right to cross runway 31L as instructed, the crew continued their taxi and crossed runway 4L, where DAL1943 had just begun its takeoff roll. The airport surface detection equipment model-x (ASDE-X) system installed at JFK provided visual and aural alerts in the air traffic control tower, and the local controller cancelled DAL1943's takeoff clearance. The DAL flight crew rejected the takeoff, reaching a maximum groundspeed of about 105 knots (120 mph) about 2,300 ft from the taxiway intersection where AAL106 was crossing runway 4L. AAL106 continued across the runway and DAL1943 came to a stop before taxiing off the runway onto an adjacent taxiway without further incident.

What We Found

We found that the flight crew of AAL106 deviated from the instructions given by ATC and inadvertently crossed runway 4L due to a surface navigation error that likely stemmed from several factors, including the timing of the instruction provided to the crew to cross runway 31L; interruptions and multitasking as the crew performed required crosschecks of their takeoff performance calculations; the captain's prospective memory error, which resulted in his forgetting to turn right onto taxiway K; and environmental capture, which prompted the captain to proceed along a familiar, but incorrect, taxi route. The ASDE-X functioned as designed and alerted the air traffic controller to the conflict between AAL106 and DAL1943, which resulted in the controller's timely cancellation of DAL1943's takeoff clearance; however, additional risk mitigation strategies are needed to reduce the likelihood that flight crew surface navigation errors will result in runway incursions. These might include procedural crosschecks that would require a flight crew to verbalize the runway they are about to cross, flight deck displays of airport traffic with aural and visual conflict alerting capability, and yet undeveloped strategies for reducing likelihood of surface navigation errors caused by the need to perform multiple concurrent operational tasks during taxi. Such strategies can be developed and tailored to the characteristics of an operator's unique constraints as part of an operator's safety management system.

The taxiway/runway intersection where the incident occurred was equipped with a runway status light system that included runway entrance lights (RELs), which comprised red lights embedded in the surface that illuminated to signal to approaching aircraft that the runway was in use. The RELs illuminated during this incident as designed; however, they illuminated as the nose of AAL106 was crossing the runway hold short markings, which was too late for the crew to perceive them and stop the airplane in a safe area. As a result, this system did not serve as an effective safeguard for alerting the crew that they were about to cross an active runway.

Finally, cockpit voice recorder (CVR) information was not available for this incident because the data were overwritten. As a result, the NTSB had to rely exclusively on flight crew recollections about the incident; however, these were not documented until 1 month after the incident occurred. A cockpit voice recording would likely have provided additional details about the content and timing of crew communications; shed light on the crew's minute-by-minute focus of attention; revealed any unreported, nonpertinent conversations; and potentially provided additional information about any distractions.

What We Recommended

As a result of this investigation, we made a safety recommendation to the FAA that they encourage Title 14 *Code of Federal Regulations* (*CFR*) Part 91K, 135, and 121 operators to require flight crews to verbalize the number of a runway they are about to cross, as indicated by runway signs, unless an installed automated system already provides an aural advisory.

We recommended that the FAA encourage 14 *CFR* Part 121 operators to use their existing safety management systems to detect flight crew surface navigation errors resulting from the performance of concurrent tasks during taxi and implement effective risk mitigation strategies considering human factors principles.

We recommended that the FAA collaborate with aircraft and avionics manufacturers and software designers to develop the technology for a flight deck system that would provide visual and aural alerts to flight crews of traffic on a runway or taxiway and traffic on approach to land. We also recommended that the FAA require this new technology to be installed in all newly certificated transport-category airplanes, and that existing transport-category airplanes be retrofitted with the technology. These recommendations superseded a recommendation that asked the FAA to require a ground movement safety system that provided a direct warning capability to flight crews.

We recommended that the FAA evaluate the effectiveness of the activation logic for the runway status light (RWSL) system considering the circumstances of this incident, and that the findings of this evaluation are used to update the RWSL system activation logic as necessary to improve system effectiveness.

We recommended that the FAA require retrofit of all CVRs on all airplanes required to carry both a CVR and a flight data recorder with a CVR capable of recording the last 25 hours of audio. This recommendation superseded a previous recommendation that asked the FAA to require such recorders by January 1, 2024.

We also reiterated our previously issued safety recommendation to the FAA that all newly manufactured airplanes that must have a CVR be fitted with a CVR capable of recording the last 25 hours of audio.

Conclusions

Findings

1. None of the following were factors in this incident: (1) pilot and controller qualifications, (2) flight crew fatigue, and (3) airport traffic control tower staffing.

2. The captain's deviation from American Airlines flight 106's taxi clearance likely resulted from several factors, including an early clearance to cross runway 31L, interruptions and multitasking related to the crew's delayed receipt of the load closeout, the captain's prospective memory error in forgetting to turn right at taxiway K, and environmental capture, which prompted the captain to proceed along a familiar, but incorrect, route.

3. The first officer and relief first officer were likely distracted from their primary duty of assisting the captain in safely taxiing the airplane by other operational activities, which resulted in the crew's loss of situational awareness during a critical phase of flight.

4. The American Airlines flight crew's nondetection of Delta Air Lines flight 1943 (DAL1943) on runway 4L likely resulted from night conditions, the location of DAL1943 within a complex array of airport lights, the distance between the two airplanes, the lack of relative motion of DAL1943 in the visual field of the crew of American Airlines flight 106, and expectation bias.

5. A procedural crosscheck that requires a flight crew to verbalize the number of a runway they are about to cross, as indicated by runway signs, would reduce the likelihood of future runway incursions resulting from flight crew surface navigation errors.

6. Additional risk mitigation strategies as part of an operator's safety management system would reduce the likelihood that flight crew performance of concurrent tasks during taxi will lead to inaccurate navigation on the airport by reducing distractions associated with multitasking.

7. The implementation of a flight deck alerting system on transport-category aircraft that provides alerts of traffic on a runway or taxiway and traffic on approach to land would enhance safety by providing pilots with improved situational awareness and would reduce the risk of future runway-related incidents and accidents.

8. The runway entrance lights operated as designed; however, they were ineffective in preventing the crew of American Airlines flight 106 from crossing the runway 4L hold short markings because they activated too late for the crew to perceive them and stop the airplane in a safe area.

9. The airport surface detection equipment model-X system at John F. Kennedy International Airport was operational at the time of the incident and functioned as designed, generating both aural and visual alerts when American Airlines flight 106 crossed runway 4L while Delta Air Lines flight 1943 was departing, and likely reduced the severity of the incident by preventing a runway collision.

10. The ground controller expected the American Airlines flight 106 crew to adhere to the assigned taxi instructions, and did not detect the flight crew's surface navigation error and subsequent turn onto taxiway J because he was performing lesser priority tasks.

11. The local controller acted in a timely and appropriate manner following the airport surface detection equipment model-X alert by cancelling Delta Air Lines flight 1943's takeoff clearance.

12. The John F. Kennedy International Airport air traffic control tower team had the responsibility of scanning the runways and airport environment but did not effectively prioritize their duties to ensure a continuous scan, which resulted in their nondetection of the American Airlines flight 106 crew's deviation from taxi instructions.

13. Cockpit voice recorders (CVRs) with a 25-hour recording capability are necessary because valuable information continues to be overwritten on CVRs that are designed to record only 2 hours of audio data.

Probable Cause

The NTSB determines that the probable cause of this incident was the American Airlines flight 106 (AAL106) crew's surface navigation error due to distractions caused by their performance of concurrent operational tasks during taxi, which resulted in a loss of situational awareness. Contributing to the incident was the air traffic control tower team's nondetection of the AAL106 crew's deviation from taxi instructions while performing concurrent operational tasks; the timing of the runway status light system, which activated too late to prevent the AAL106 crew from crossing the runway hold short line; and American Airlines' lack of adequate risk controls to prevent concurrent flight crew tasks from leading to distraction, loss of situational awareness, and deviation from an authorized taxi clearance. Reducing the severity of the

incident, and likely preventing an accident, was the activation of the ASDE-X warning in the air traffic control tower and the local controller's prompt cancellation of DAL1943's takeoff clearance.

Safety 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:

1. Encourage Title 14 *Code of Federal Regulations* Part 91K, 135, and 121 operators to incorporate into their standard operating procedures a procedural crosscheck that requires flight crews to verbalize the number of a runway they are about to cross, as indicated by runway signs, unless an installed automated system already provides an aural advisory. **(A-24-2)**

2. Encourage Title 14 *Code of Federal Regulations* Part 121 operators to use their safety management system to identify flight crew surface navigation errors resulting from the performance of concurrent tasks during taxi and develop and implement effective risk mitigation strategies considering human factors principles. **(A-24-3)**

3. Collaborate with aircraft and avionics manufacturers and software designers to develop the technology for a flight deck system that would provide visual and aural alerts to flight crews of traffic on a runway or taxiway and traffic on approach to land. **(A-24-4)**

4. Require that the technology developed in response to Safety Recommendation A-24-4 be installed in all newly certificated transport-category airplanes. **(A-24-5)**

5. Require that existing transport-category airplanes be retrofitted with the technology developed in response to Safety Recommendation A-24-4. **(A-24-6)**

6. Evaluate the effectiveness of the activation logic for the runway status light system considering the circumstances of this incident. **(A-24-7)**

7. Using the findings of the evaluation conducted in response to Safety Recommendation A-24-7, update the runway status light system activation logic as necessary to improve system effectiveness. **(A-24-8)**

8. Require retrofit of all cockpit voice recorders (CVR) on all airplanes required to carry both a CVR and a flight data recorder with a CVR capable of recording the last 25 hours of audio. **(A-24-9)**

Previously Issued Recommendations Reiterated in this Report

To the Federal Aviation Administration:

Require all newly manufactured airplanes that must have a cockpit voice recorder (CVR) be fitted with a CVR capable of recording the last 25 hours of audio. (A-18-30)

Previously Issued Recommendations Classified in this Report

To the Federal Aviation Administration:

Require, at all airports with scheduled passenger service, a ground movement safety system that will prevent runway incursions; the system should provide a direct warning capability to flight crews. In addition, demonstrate through computer simulations or other means that the system will, in fact, prevent incursions. (A-00-66)

Safety Recommendation A-00-66 is classified "Closed—Unacceptable Action/Superseded" in section 2.3.3 of the report. This recommendation is superseded by Safety Recommendations A-24-4 through -6.

By January 1, 2024, require retrofit of all cockpit voice recorders (CVR) on all airplanes required to carry both a CVR and a flight data recorder with a CVR capable of recording the last 25 hours of audio. (A-18-31)

Safety Recommendation A-18-31 is classified "Closed—Unacceptable Action/Superseded" in section 2.6 of the report. This recommendation is superseded by A-24-9, which is classified "Open—Unacceptable Response."