NATIONAL TRANSPORTATION SAFETY BOARD
Board Meeting of June 24, 2025
(Information subject to editing)

In-Flight Separation of Left Mid Exit Door Plug
Alaska Airlines Flight 1282, Boeing 737-9, N704AL
January 5, 2024
DCA24MA063

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 to reflect changes adopted during the Board meeting.

Executive Summary

What Happened

On January 5, 2024, a Boeing 737-9 airplane operated by Alaska Airlines as flight 1282 experienced an in-flight separation of the left mid exit door (MED) plug and rapid depressurization when climbing through about 14,830 ft after takeoff from Portland International Airport (PDX), Portland, Oregon. One flight attendant and 7 passengers received minor injuries; the captain, the first officer, 3 flight attendants, and 164 passengers were uninjured; and the airplane sustained substantial damage. The flight and cabin crews executed the emergency procedures in response to the rapid depressurization, and the flight returned to PDX for a safe landing.

The airplane had a hole in the fuselage where the left MED plug (a rectangular airframe structure about 29 inches wide and 59 inches high) had been installed. Components on the fuselage frame that surrounded the hole, including fittings and assemblies associated with the left MED plug installation, were damaged. The passenger seats and cabin interior located nearest the hole were also damaged, and a seatback tray table, two seat headrests, and cabin interior panels were missing. The airplane's left MED plug and some of the seat and interior pieces were located on the ground (along the airplane's flight path) and recovered. Multiple components associated with the left MED plug installation, including four bolts that would secure the left MED plug from moving upward vertically, were not located.

What We Found

The National Transportation Safety Board found that the four bolts that secured the left MED plug to prevent it from moving upward vertically were missing before the newly manufactured airplane was delivered to Alaska Airlines. As a result, the left MED plug was able to become displaced gradually upward (by fractions of an inch) during previous flights until, during the accident flight, it displaced upward enough to disengage from its stop fittings and separate in flight. The upward displacement before the accident flight would not have been detectable during a routine preflight inspection, and there was no evidence this upward displacement was associated with previous pressurization system AUTO FAIL light illumination events.

We determined that, when the airplane was manufactured, Boeing personnel had opened the left MED plug (which inherently required removing the four bolts and associated hardware) to allow access for rivet rework to be performed on the edge frame forward of the left MED plug. However, opening an MED plug was a nonroutine task, and no personnel experienced with opening or closing an MED plug were on duty at the times that the accident airplane's left MED plug was opened and closed, and none said they had any knowledge of who opened it.

We found that, per Boeing's Business Process Instruction (BPI) for performing parts removals, opening an MED plug, because it was a disturbance of a previously accepted installation, required the generation of a removal record. The purpose of a removal record was to document that parts were removed from the airplane and to specify the tasks and quality assurance signoffs required to ensure that the installation was subsequently restored to an accepted condition. However, we found that no removal record was generated. The left MED plug was subsequently closed without its securing bolts and attachment hardware, and no quality assurance inspection of the plug closure was performed. In addition, Boeing's short stamp process, which was intended to document the work that needed to be deferred or "traveled" to allow for the rivet rework, was not correctly applied for the accident airplane. We found that, although the short stamp process does not negate the need to generate a required removal record for disturbed installations, had the short stamp process been correctly applied, it may have provided an opportunity for personnel to detect the left MED plug's missing bolts and attachment hardware.

We also found that Boeing's BPI for performing parts removals lacked the clarity, conciseness, and ease of use necessary to be an effective tool for workers in the manufacturing process. The BPI had a documented history of compliance issues for at least 10 years before the accident. However, Boeing's corrective actions to address the

issues, which were accepted by the Federal Aviation Administration (FAA), were ineffective to address the persistent deficiencies with the BPI.

We also found that Boeing's on-the-job training for generating removal records was insufficient, which decreased the likelihood that personnel with limited exposure to nonroutine tasks could correctly open an MED plug and generate the required removal record.

We found that the Federal Aviation Administration's (FAA) compliance and enforcement surveillance, audit planning procedures, and records systems were inadequate to identify repetitive and systemic discrepancies and nonconformance issues with the BPI for parts removals. Also, Boeing's quality escape guidance did not adequately address controls for human error, and its voluntary safety management system, which was still being developed at the time the accident airplane was in production, did not proactively identify the risk of the quality escape that occurred. We determined that, for Boeing's future implementation of its regulatory safety management system (SMS) and integration into its quality management system to be successful, accurate and ongoing data about its safety culture is needed.

We also found that the circumstances of this accident and others in which the flight crew faced communications challenges associated with oxygen mask use highlighted the need for hands-on, aircraft-specific training and procedures for the use of each type of oxygen system in an operator's fleet. We also identified the need for the FAA to review the design standards for portable oxygen bottles to ensure that they adequately address ease of use.

Further, the circumstances of this accident emphasized the need for effective operator procedures for preserving cockpit voice recorder (CVR) data after an accident or incident occurs, as well as the continued need for installations and retrofits of CVRs with a 25-hour recording capability. We found it continues to be necessary to address these issues because valuable information continues to be overwritten on CVRs that are designed to record only 2 hours of audio data. Finally, although the three lap-held children on board the accident airplane did not sustain any injuries, we found that the potential for severe injury or death existed and reinforced the prudence of using a child restraint system (CRS) for children less than 2 years old appropriate to their size and weight.

Probable Cause

We determined that the probable cause of this accident was the in-flight separation of the left MED plug due to Boeing's failure to provide adequate training, guidance, and oversight necessary to ensure that manufacturing personnel could consistently and correctly comply with its parts removal process, which was intended to document and ensure that

the securing bolts and hardware that were removed to facilitate rework during the manufacturing process were properly reinstalled. Contributing to the accident was the FAA's ineffective compliance enforcement surveillance and audit planning activities, which failed to adequately identify and ensure that Boeing addressed the repetitive and systemic nonconformance issues associated with its parts removal process.

What We Recommended

As a result of this investigation, we made safety recommendations to the FAA and Boeing.

We recommended that the FAA revise its compliance enforcement surveillance system, audit planning activities, and records systems to ensure that they provide functionality to enable FAA managers and inspectors who provide oversight of production approval holders to identify, record, track, and effectively address repetitive and systemic discrepancies and nonconformance issues, including those related to specific manufacturing processes. We also recommended that the FAA develop guidance and provide recurrent training to those managers and inspectors.

We also recommended that the FAA retain historical compliance enforcement and audit records older than 5 years and provide FAA managers and inspectors access to these records to enhance their oversight for production approval holders. In addition, we recommended that the FAA convene an independent third-party panel to conduct a comprehensive review of Boeing's safety culture, such that the findings should be used to enhance Boeing's ongoing development of its regulatory SMS and the integration of its SMS into its broader QMS.

Additionally, we recommended that the FAA notify operators of the circumstances of this accident and encourage them to review their flight crew training programs and ensure that they provide hands-on, aircraft-specific training and procedures for each type of oxygen system in the operator's fleet, to include establishing and maintaining communications when oxygen masks are donned and removed while participating in realistic emergency procedures training scenarios. We further recommended that the FAA review and revise, as necessary, the design standards for portable oxygen bottles.

We also recommended that the FAA require operators of airplanes equipped with a CVR to incorporate guidance into company standard operating procedures, emergency protocols, and postincident and postaccident checklists—applicable to both flight crew and non-flight crew personnel—detailing actions to preserve CVR recordings as soon as practical following a flight with a reportable event.

We recommended that Boeing continue the certification process for the design enhancement for MED plugs to ensure that, once the design enhancement is certified, all

applicable newly manufactured airplanes are equipped with the enhancement. We also recommended that Boeing issue a service bulletin to address retrofitting in-service airplanes, and that the FAA issue an airworthiness directive to require that all in-service MED plug-equipped airplanes be retrofitted with the design enhancement.

We also recommended that Boeing revise its BPI for parts removals to include clear and concise guidance for determining when a removal record is needed and develop recurrent training for manufacturing personnel that emphasizes the importance of removal records for product safety, prepares personnel to consistently and correctly determine when a removal record is needed, and ensures that a removal record is generated when required.

We recommended that Boeing develop a structured on-the-job training program that identifies and defines tasks necessary for manufacturing personnel to be considered fully qualified in their job series and includes a grading system for trainers and trainees to track progression and determine competence. We also recommended that Boeing document and archive the training provided and received to support future data analysis.

We recommended that Boeing revise its safety risk management process to ensure that it identifies the root causes of compliance issues, like the persistent deficiencies with the BPI for parts removals and other production process inconsistencies, and evaluate the effectiveness of corrective actions.

We also recommended that Boeing develop a process that can identify escapes that result from human error, assess them using a system specifically designed to identify factors that contribute to such errors, and implement effective mitigation strategies.

In addition, we reiterated our previously issued safety recommendations to the FAA related to requiring a CVR capable of recording the last 25 hours of audio (for all airplanes already required to be equipped with both a CVR and a flight data recorder); conducting a study to determine the factors, including any challenges, that affect caregivers' decisions about using CRSs when traveling with children under the age of 2 on aircraft operated under Part 121; and using the study's findings to direct the FAA's efforts to increase CRS use.

We also reiterated our previously issued safety recommendations to the Airlines for America, the National Air Carrier Association, and the Regional Airline Association related to coordinating with their member airlines to develop and implement a program to increase CRS usage in airplanes and collecting data to determine the program's effectiveness at increasing CRS use.

Findings

1. The flight and cabin crewmembers were certificated and qualified in accordance with applicable federal regulations and Alaska Airlines' requirements.
2. There was no evidence that Alaska Airlines performed any maintenance, inspection, or retrofit work on the airplane since delivery that would involve opening the left mid exit door plug.
3. The left mid exit door plug displaced incrementally upward during previous flights; then, during the accident flight, it displaced upward to the point of stop pin to stop pad instability, then upward, outboard, and aft as it separated from the fuselage.
4. The evidence of the upward displacement of the left mid exit door plug before the accident flight would not have been readily detectable by a flight crewmember performing a routine preflight walkaround inspection.
5. The airplane's cabin pressurization system operated as designed both before and after the left mid exit door (MED) plug separated, and there was no evidence that the previous pressurization system AUTO FAIL light illumination events were associated with the left MED plug's upward displacement during previous flights.
6. The flight crew's immediate actions to don their oxygen masks after the rapid depressurization and use the "CABIN ALTITUDE or Rapid Depressurization" checklist were consistent with company procedures, their decision to descend the airplane and return to the departure airport was timely and appropriate, and they demonstrated effective high-workload management and task allocation appropriate for a two-person crew to safely handle the emergency.
7. The teamwork and complementary duties of the flight crew, which occurred during the emergency, reinforce the necessity for a minimum crew of two pilots, as specified in the airplane type certificate, as well as Title 14 *Code of Federal Regulations* Part 121 operating rules.
8. Although the flight crew did not perform the procedures to switch communications back to their headsets after removing their oxygen masks, this had no adverse effect on their subsequent safe landing of the airplane.
9. Flight attendant A's difficulty communicating with the flight crew and challenges communicating with the other cabin crewmembers did not impede the cabin crew's ability to execute cabin procedures and effectively ensure the safety of the

passengers, including unaccompanied minors, after the rapid depressurization and during the descent and return to the airport.

10. All flight attendants and passengers were able to use the overhead oxygen masks to obtain oxygen after the rapid depressurization, and the portable oxygen bottles provided oxygen to the two flight attendants who used them to move through the cabin.

11. The absence of bolt contact damage or deformation around the holes associated with the vertical movement arrestor bolts and upper guide track bolts indicates that the four bolts that should have been installed to prevent the left mid exit door plug's upward movement were missing before the plug moved upward off the stop pads.

12. The left mid exit door plug's vertical movement arrestor bolts, upper guide track bolts, and associated hardware were installed before the fuselage was delivered to Boeing but subsequently removed during the manufacturing process when the plug was opened to facilitate additional work.

13. Neither the door team manager nor any of the door team personnel on duty when the left mid exit door (MED) plug was opened had any experience with opening an MED plug, and none said they had any knowledge of who opened it.

14. Whoever opened the left mid exit door plug did not generate a removal record, which increased the risk that the closure would not be performed properly due to the absence of the documented steps for the bolts and hardware to be reinstalled and for a quality assurance inspection to verify that the installation was restored to accepted condition.

15. Boeing Commercial Airplanes' Business Process Instruction "Perform Part or Assembly Removal" lacked clarity, conciseness, and ease of use necessary to be an effective tool for manufacturing personnel to consistently and correctly determine when and how to generate a removal record.

16. Boeing Commercial Airplanes' on-the-job training was unstructured, undocumented, and focused primarily on routine build tasks, which decreased the likelihood that door team personnel with limited exposure to nonroutine tasks would be able to correctly perform the process for opening a mid exit door plug, including generating the required removal record.

17. Only door team personnel were allowed to perform work on doors and mid exit door (MED) plugs, but none were on duty at the time the left MED plug was closed.

18. Due to the absence of a removal record indicating that the left mid exit door plug installation had been disturbed, no quality assurance inspection of the plug closure was performed.

19. The postaccident design enhancement of the mid exit door (MED) plug, if certified by the Federal Aviation Administration and implemented by Boeing Commercial Airplanes, will help ensure the complete closure of an MED plug following opening or removal.

20. Because Boeing Commercial Airplanes did not conduct a change management assessment to identify and address the risks associated with using a workforce with reduced experience, including hiring many with little or no previous manufacturing experience, it missed an opportunity to proactively implement mitigations to ensure quality standards were maintained.

21. Although accepted by the Federal Aviation Administration, Boeing Commercial Airplanes' corrective actions were ineffective to address the persistent deficiencies with Boeing's Business Process Instruction "Perform Part or Assembly Removal," which had a documented history of compliance issues for at least 10 years before the accident.

22. Although Boeing Commercial Airplanes' short stamp process for deferred or traveled work does not negate the need to generate a required removal record for disturbed installations, had the short stamp process been correctly applied on Boeing Installation Plan "OK to Install Blankets" for the accident airplane, it may have provided an opportunity for personnel to detect the left mid exit door plug's missing bolts and attachment hardware.

23. The Federal Aviation Administration's compliance and enforcement surveillance, audit planning assessments, and records systems were deficient and lacked the functionality necessary to identify repetitive and systemic discrepancies and nonconformance issues with Boeing Commercial Airplanes' Business Process Instruction "Perform Part or Assembly Removal," including previous instances of undocumented part removals.

24. Boeing Commercial Airplanes' quality escape guidance, which focused on components rather than the actions of people performing tasks, did not adequately address controls for human error, leaving a gap in Boeing's ability to identify and build effective mitigation strategies.

25. In the 2 years before the accident airplane's production, Boeing Commercial Airplanes' voluntary safety management system was an immature program that

lacked formal Federal Aviation Administration oversight and did not proactively identify the risk of the quality escape that occurred.

26. Having a fully developed safety management system, implemented at every level of the quality management and production process, will provide Boeing Commercial Airplanes with a systematic approach to proactively identifying and managing the human risks associated with aircraft production.

27. Due to the mixed perspectives provided by the relatively small sample size of employees interviewed about the accident airplane's left mid exit door plug and the prolonged work stoppage at Boeing Commercial Airplanes that precluded the National Transportation Safety Board from conducting a broader safety culture survey, an assessment of Boeing's safety culture, including whether adverse pressure existed on the production line, could not be performed as part of this investigation.

28. For future implementation of Boeing Commercial Airplanes' regulatory safety management system and integration into its quality management system to be successful, accurate and ongoing data about its safety culture is needed.

29. While hands-on oxygen mask simulator training was provided to the flight crew before the accident, it lacked realistic scenario-based exercises and, therefore, failed to adequately prepare them for potential real-world events.

30. The circumstances of this accident and others highlight the need for hands-on, aircraft-specific crew training and procedures for the use of each type of oxygen system in an operator's fleet, including donning masks, communicating with them on, and reestablishing communications after removing masks.

31. Although the portable oxygen bottles used by the flight attendants met Federal Aviation Administration design standards, the difficulties the flight attendants encountered when using the masks, including the need to improvise a tool to open the packaging, suggest that the standards, the mask design, or both do not adequately consider ease of use and quick donning in an emergency.

32. Alaska Airlines' procedures at the time of the accident were ineffective in ensuring that the cockpit voice recorder data were preserved from the accident flight, resulting in the loss of critical information for the investigation.

33. The circumstances of this accident and others show that cockpit voice recorders (CVR) 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.

34. The Federal Aviation Administration's emphasis on increasing voluntary usage of child restraint systems, rather than mandating their use as the National Transportation Safety Board has long recommended, has continued to allow children under the age of 2 years to travel on board aircraft at a lower level of safety than that of seat belt-wearing adult passengers.

35. Although none of the three lap-held children on board the airplane sustained injury, the circumstances of this accident and others show that the potential for severe injury or death exists for children less than 2 years old who are not secured in a child restraint system appropriate to their size and weight.

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. Once you complete the certification of Boeing Commercial Airplanes' design enhancement for ensuring the complete closure of Boeing 737 mid exit door (MED) plugs following opening or removal, issue an airworthiness directive to require that all in-service MED plug-equipped airplanes be retrofitted with the design enhancement.

2. Revise your compliance enforcement surveillance system to ensure that it provides the necessary functionality for Federal Aviation Administration managers and inspectors overseeing production approval holders to effectively identify, record, track, and resolve recurring and systemic discrepancies and nonconformance issues, including those related to specific manufacturing processes.

3. Revise your audit planning activities to ensure that they provide the necessary functionality for Federal Aviation Administration managers and inspectors overseeing production approval holders to effectively identify, record, track, and resolve recurring and systemic discrepancies and nonconformance issues, including those related to specific manufacturing processes.

4. Revise your records systems to ensure that they provide the necessary records for Federal Aviation Administration managers and inspectors overseeing production approval holders to effectively identify, record, track, and resolve recurring and systemic discrepancies and nonconformance issues, including those related to specific manufacturing processes.

5. Once the actions in Safety Recommendations 2 through 4 are completed, develop guidance for Federal Aviation Administration managers and inspectors who provide oversight of production approval holders on how to identify, record, track, and effectively address repetitive and systemic discrepancies and nonconformance issues, to include strategies for assessing the effectiveness of corrective actions taken by the production approval holder during the previous year when developing next year's certificate management plan.

6. Once the actions in Safety Recommendation 5 are completed, provide Federal Aviation Administration managers and inspectors who provide oversight of production approval holders with recurrent training on how to identify, record, track, and effectively address repetitive and systemic discrepancies and nonconformance issues, to include strategies for assessing the effectiveness of corrective actions taken by the production approval holder during the previous year when developing next year's certificate management plan.

7. Retain historical compliance enforcement surveillance and audit records older than 5 years and provide Federal Aviation Administration managers and inspectors access to these records to enhance their oversight planning for production approval holders.

8. Convene an independent third-party panel to conduct a comprehensive review of Boeing Commercial Airplanes' safety culture. The findings should be used to enhance the ongoing development of Boeing's regulatory safety management system (SMS) and the integration of its SMS into its broader quality management system.

9. Notify operators of the circumstances of the accident involving Alaska Airlines flight 1282, and encourage them to review their flight crew training programs and ensure that they include hands-on, aircraft-specific training and procedures for each type of oxygen system in the operator's fleet, to include establishing and maintaining communications when the oxygen masks are donned and removed while participating in realistic emergency procedures training scenarios.

10. Review and revise, as necessary, the design standards that apply to portable oxygen bottle design to ensure that they adequately address ease of use and quick donning in an emergency situation, including considerations for the effort needed to remove the mask from its packaging.

11. Require operators of airplanes equipped with a cockpit voice recorder (CVR) to incorporate guidance into company standard operating procedures, emergency protocols, and postincident and postaccident checklists—applicable to both flight crew and non-flight crew personnel—detailing actions to preserve CVR recordings as soon as practical after completion of a flight with a reportable event.

To The Boeing Company:

12. Continue the certification process for the design enhancement for mid exit door plugs to ensure that, once the design enhancement is certified, all applicable newly manufactured airplanes are equipped with the enhancement.

13. Once the design enhancement for mid exit door (MED) plugs is certified, issue a service bulletin to address retrofitting in-service MED plug-equipped airplanes with the design enhancement.

14. Apply your updated safety risk management process to current and future revisions to Business Process Instruction "Perform Part or Assembly Removal" to ensure that it proves clear and concise guidance for determining when a removal record is needed.

15. Develop recurrent training on Business Process Instruction "Perform Part or Assembly Removal" for Boeing Commercial Airplanes' manufacturing personnel that emphasizes the importance of removal records for product safety, prepares personnel to consistently and correctly determine when a removal record is needed, and ensures that a removal record is generated when required.

16. Develop a structured on-the-job training program that identifies and defines tasks necessary for manufacturing personnel to be considered fully qualified in their job series and includes a grading system for trainers and trainees to track progress and determine competence.

17. Document and archive the results of training provided and received as part of the program recommended in Safety Recommendation 16 to support future data analysis.

18. Revise your safety risk management process to ensure that it 1) identifies the root causes of manufacturing process compliance issues, like the persistent deficiencies with Business Process Instruction "Perform Part or Assembly Removal" and other production process inconsistencies identified in this investigation, and 2) evaluates the effectiveness of corrective actions.

19. As you integrate your quality management system and safety management system, develop a process that can identify escapes that result from human error, assess them using a system specifically designed to identify factors that contribute to such errors, and implement effective mitigation strategies.

Previously Issued Recommendations Reiterated in This Report

The National Transportation Safety Board reiterates the following safety recommendations.

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)

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)

Conduct a study to determine the factors that affect caregivers' decisions about the use of child restraint systems (CRSs) when traveling on a Title 14 Code of Federal Regulations Part 121 air carrier airplane with children under the age of 2 and to understand the challenges associated with using CRSs; publish the study findings. (A-21-40)

After the action in Safety Recommendation A-21-40 is completed, use the study findings to direct the Federal Aviation Administration's efforts to increase child restraint system usage. (A-21-41)

To the Airlines for America, the National Air Carrier Association, and the Regional Airline Association:

Coordinate with your member airlines to develop and implement a program to increase child restraint system (CRS) usage in airplanes; this effort should include collecting data to determine the program's effectiveness at increasing CRS usage. (A-21-45)