

16. The captain made the decision to continue the takeoff, as indicated by his command "Lets take it off" during the takeoff roll. He made that decision, however, without aircraft control inputs upon which to determine the cause of the abnormal aircraft behavior.
17. Before the crew fully realized the criticalness of their situation, the takeoff had progressed to a point where they had little or no time to reject the takeoff successfully. This was caused by a combination of factors including inadequate explanation of the rejected takeoff procedures in the handbooks, de-emphasizing of rejected takeoff procedures because of environmental pressures, and the lack of planning for such events before takeoff.

(b) Probable Cause

The Board determines that the probable cause of this accident was a loss of pitch control caused by the entrapment of a pointed, asphalt-covered object between the leading edge of the right elevator and the right horizontal spar web access door in the aft part of the stabilizer. The restriction to elevator movement, caused by a highly unusual and unknown condition, was not detected by the crew in time to reject the takeoff successfully. However, an apparent lack of crew responsiveness to a highly unusual emergency situation, coupled with the captain's failure to monitor adequately the takeoff, contributed to the failure to reject the takeoff.

A70-54

3. RECOMMENDATIONS

Based on the results of the investigation of this accident, the Board recommended to the Administrator, Federal Aviation Administration, that (1) all DC-8 operators be advised of the hazardous condition that can be created by foreign objects jamming the aircraft's elevators; (2) all DC-8 operators should be advised that takeoffs should be rejected when premature or unacceptable rotation occurs during takeoff until adequate procedures are developed for a positive check of elevator position; (3) the DC-8 flight control system should be evaluated by the FAA with a view to establishing a standard procedure for checking the system from the cockpit. This procedure should provide for positive detection of a jammed elevator; and (4) consideration be given for a requirement to install an elevator position indicator in the cockpit of all DC-8 aircraft.

The Administrator replied November 20, 1970, that engineering evaluations were being completed at Douglas Aircraft Company. He stated that additional time was required to complete these evaluations and he would advise the Board of any action taken as soon as the evaluations

8. Scratches and gouges were found on the surface of a right horizontal spar web access door and on the leading edge of the right horizontal stabilizer immediately opposite the scarred area. There were smears of asphaltic material on the surface of the access door in the area of the scars.
9. It was calculated that the elevator was in a 12° to 15° trailing-edge-up position when the initial scratches were made. A short distance above the scratches on the access door, a hole was punched in the skin of the door. It was calculated that the elevator was approximately 8° to 11° trailing edge up when the hole was punched in the door.
10. The construction of the empennage of this aircraft is such that when a foreign object is placed on top of the horizontal tail, it tends to slide inboard and toward the area between the stabilizer and elevator. If the object is too large to pass between these two components, it will remain in this area. When an elevator trailing-edge-up condition exists, the object drops down into the gap and will resist a return of the elevator to the level position.
11. An object with a contact line of 2 inches or less could have punched through the access door and no restriction to elevator motion would have occurred. An object with a greater contact line than specified would distribute the forces over a greater area and would not penetrate the skin, under the elevator loads existing at takeoff.
12. In this case, the object had an irregular surface and eventually the imposed forces were concentrated on a point or sharp edge causing the puncture, but the object was too large to pass through the hole in the door.
13. The object stayed between the elevator and the stabilizer, holding the elevator in an approximate 5° to 8° trailing-edge-up position until initial aircraft impact.
14. With the elevator jammed in this position, there was not adequate pitch control available to the pilots to correct the attitude of the aircraft after it became airborne.
15. The captain was responsible, by TIA standards, for any initiation of rejected takeoff procedures.

were completed. The Administrator also stated that he needed additional clarification regarding Recommendation No. 2.

The Administrator, on March 8, 1971, reported that he had completed his review and investigation of our recommendations. He stated that the manufacturer had developed a procedure to check for elevator movement and jamming prior to takeoff and that the FAA had issued an operations alert December 1, 1970, requesting that this procedure be brought to the attention of all DC-8 operators. He further stated that the usefulness and value of an elevator position indicator would not justify the large cost and complexity of the installation due to the design of the elevator control system. (See Attachment 3.)

Since a rejected takeoff is a normal response to an emergency event which occurs before flying speed is reached, this would appear to be an event that should be preplanned by flightcrews. Some flight operations recognize the value of proper communication and preparation for contingencies and require flightcrew briefings on takeoff procedures, possible emergencies, and duty assignments dependent on which pilot is handling the flight controls. The value of such a procedure is that each crewmember is mentally prepared for such eventualities each time a flight is commenced.

Our review of flight manuals and operations manuals indicates that the procedures contained in these manuals could be improved by being more specific in duty assignments and functions during a rejected takeoff, particularly by clarifying each pilot's duties in cases where the copilot is handling the flight controls and a rejected takeoff is required. In this connection, the Board believes that the history of rejected takeoff accidents and incidents indicates that additional emphasis is needed on factors other than engine failure that might require the initiation of a rejected takeoff procedure.

Therefore, the Board recommends that:

The Federal Aviation Administration review the subject of rejected takeoff procedures in air carrier operations with a view to: amplifying and clarifying these procedures; standardizing operation and flight manual procedures for each aircraft; reviewing the role each pilot plays in accomplishing a rejected takeoff; exploring the requirements for rejected takeoff training; providing flightcrews with more specific information regarding the dynamics of rejected takeoff conditions for the specific aircraft; and, requiring a pretakeoff briefing of rejected takeoff and other emergency procedures that the crew may have to employ.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD:

/s/ JOHN H. REED
Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ LOUIS M. THAYER
Member

/s/ ISABEL A. BURGESS
Member

Oscar M. Laurel, Member, was absent, not voting.

August 18, 1971