



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: April 26, 2001

In reply refer to: A-01-12 and -13

Honorable Jane F. Garvey
Administrator
Federal Aviation Administration
Washington, D.C. 20591

On March 5, 2000, about 1811 Pacific standard time, Southwest Airlines flight 1455, a Boeing 737-300, overran the departure end of runway 8 after landing at Burbank Glendale Pasadena Airport, Burbank, California. The airplane touched down at approximately 181 knots, and about 20 seconds later, at approximately 32 knots, collided with a blast fence and an airport perimeter wall and came to rest on a city street outside of the airport property. During the accident sequence, the forward service door (1R) slide inflated inside the airplane, the nose gear collapsed, and the forward flight attendant jumpseat, which was occupied by two flight attendants, partially collapsed. There was no postaccident fire. Of the 142 persons on board, 2 passengers sustained serious injuries; 41 passengers and 1 flight crewmember sustained minor injuries; and 94 passengers, 3 flight attendants, and 1 flight crewmember were uninjured. The airplane sustained extensive damage. Although this accident investigation is ongoing,¹ the National Transportation Safety Board has identified two safety issues that require the FAA's attention.

Slide Cover Latch Brackets

The escape slides on Boeing 737 (737) doors are restrained by a rigid plastic slide cover that is attached to the door by a hinge along the top edge and by two U-shaped slide cover latch brackets along the bottom edge. One of the brackets is attached to the slide cover, and the other is attached to the bottom edge of the door. The two brackets mate, and a latch connects and

¹ The description for this accident, DCA00MA030, can be found on the National Transportation Safety Board's Web site at <<http://www.nts.gov>>.

secures the brackets with pins. The slide therefore stays inside the slide cover when the cover is closed. The latch is connected to a girt bar by a stainless steel chain. When the girt bar is inserted into its brackets (“armed” mode) and the door is opened, the chain pulls on the latch, releasing the pins, and the brackets separate. The brackets then disengage from each other, and the slide pack slips out of the slide cover and is suspended over the door sill. The weight of the slide pack tensions an automatic inflation lanyard, which discharges an inflation bottle that is contained in the slide pack, and the slide inflates.

The Safety Board’s investigation revealed that the 1R slide cover latch had disengaged from the brackets, allowing the slide pack to slip out of the cover and onto the galley floor, and that the slide inflated inside of the airplane.² Flight attendants reported that the slide began inflating while the airplane was still moving. The investigation has determined that the inflation most likely was triggered by the airplane swerving to the right during the hard braking phase of the accident sequence. The weight of the uninflated slide as it moved left during this swerve apparently exerted sufficient force on the inflation lanyard to discharge the inflation bottle and inflate the escape slide. Therefore, the slide cover latch must have disengaged from the brackets before the swerve. The inflated slide extended nearly across the entire width of the airplane, blocking the aisle from the passenger cabin to both forward door exits (1R and 1L) and preventing the two flight attendants seated on the forward jumpseat from assisting in the evacuation. The escape slide was not deflated until after the evacuation (using the overwing exits and the 2L door exit) was complete.

The Safety Board notes that the escape slides on 737-600, -700, -800, and -900 (referred to as “next generation” [NG]) series airplanes are required by 14 *Code of Federal Regulations* (CFR) 25.810(a)(1)(v) to pass tests demonstrating that they will function properly after being subjected to ultimate inertia forces resulting from a simulated “minor crash landing.”³ However, this requirement does not apply to earlier 737 airplanes (including the accident airplane),⁴ which were certificated before the requirement was added to the regulations.

During certification testing of the escape slide assemblies on 737-NG series airplanes, Boeing engineers identified a propensity for the slide cover latch on forward slide compartments⁵ to partially disengage⁶ from the brackets when subjected to the prescribed inertia forces. To prevent latch disengagement, Boeing increased the slide cover latch bracket material thickness from 0.063 inch to 0.090 inch and widened the web of the bracket by 0.250 inch to

² Examination of the escape slide components revealed no anomalies with the 1R escape slide, slide cover, or deployment linkage.

³ This requirement was added to 14 CFR 25.810 on July 20, 1990. Those ultimate inertia forces are defined in 14 CFR 25.561(b)(3) as 3.0 acceleration of gravity (g) upward, 9.0 g forward, 3.0 g sideward, 6.0 g downward, and 1.5 g rearward.

⁴ According to Boeing, there are 1,988 Boeing 737-300 through -500 series airplanes, all of which have the same design slide cover latch brackets (on forward slide compartments) as those installed on the accident airplane. Boeing 737-100 and -200 series airplanes have slide cover latch brackets (on forward slide compartments) that are designed differently.

⁵ The slide cover latch brackets on the aft slide covers are designed differently because of the geometry of the doors and did not disengage during the inertia tests.

⁶ The pin on one side of the latch disengaged from the brackets.

provide additional resistance to load-induced deformation. These modifications successfully prevented disengagement of the slide cover latch bracket during subsequent certification tests and did not adversely affect the normal deployment and inflation of the slides. Accordingly, the modified slide cover latch brackets on the two forward doors are part of the type certification basis for 737-NG series airplanes.

The Safety Board is concerned that the inadvertent deployment and inflation of the escape slide in this accident resulted in the blockage of two floor-level emergency exits and prevented two flight attendants from assisting passengers during the evacuation. In addition, the inflated slide could have seriously injured the flight attendants seated on the jumpseat. During its investigation of this accident, the Board determined that the deployment and inflation of the escape slide inside the accident airplane might have been prevented if the slide cover latch brackets on the forward slide compartment had been more resistant to load-induced deformation, as are the brackets on the 737-NG series airplanes. Because the forces in this accident were not as high as the forces specified in 14 CFR 25.561(b)(3), the type of brackets installed on forward slide compartments of 737-NG series airplanes likely would have prevented the bracket from disengaging.⁷ Therefore, the Safety Board believes that the Federal Aviation Administration (FAA) should issue an airworthiness directive (AD) to require all operators of Boeing 737-300 through -500 series airplanes to replace the slide cover latch brackets on forward slide compartments with the type of slide cover latch brackets installed on the forward slide compartments of Boeing 737-600 through -900 series airplanes.

Pivot Bracket Assemblies on Trans Aero Industries Model 90835 Jumpseats

The forward flight attendant jumpseat on the accident airplane was a Trans Aero Industries Model 90835 jumpseat. The back of the jumpseat is mounted on the bulkhead between the cabin and cockpit. Roller fittings are mounted to the back of the seat bottom and move vertically within a channel in the seat back mounting structure. Brackets, mounted to the structure by bolts, attach pivot arms to the seat back mounting structure. The seat bottom roller fittings and the pivot arm assemblies allow the self-stowing seat bottom to pivot to a vertical position when it is not occupied and rest below the seat back. According to the manufacturer, Model 90835 jumpseats are only installed on 737-300 through -500 series airplanes.

The Safety Board's postaccident examination of the forward flight attendant jumpseat revealed that the pivot bracket mounting bolts were loose, and wear patterns in the adjacent structure indicated that they were loose before the accident. The loose mounting bolts allowed the bracket to move side-to-side, severely reducing the strength of the pivot bracket assembly under applied vertical loads. The vertical loads that resulted from the nose gear collapse caused the jumpseat pivot bracket mounting bolt to shear through the bottom of the bracket, resulting in the seat partially collapsing and impeding the inboard flight attendant from getting out of the seat. If the vertical impact forces had been higher, the broken pivot bracket might have led to complete separation of the seat bottom and caused injury to one or both of the flight attendants occupying the seat.

⁷ Boeing has indicated that it plans to issue a service bulletin to require that operators of 737-300 through -500 series airplanes replace the slide cover latch brackets on the forward slide compartments with the type of bracket used on the forward slide compartments of 737-NG series airplanes.

An AD (AD 89-14-11) requires periodic routine inspections of the seat bottom roller fittings on all Trans Aero Industries Model 90835 jumpseats. However, the AD does not address the pivot brackets, which do not receive scheduled maintenance checks; they are serviced only after reported problems. The Safety Board notes that periodic inspections (at appropriate intervals)⁸ of the pivot bracket assemblies on the forward flight attendant jumpseat on the accident airplane would likely have detected the loose pivot bracket mounting bolts. Therefore, the Safety Board believes that the FAA should issue an AD to require initial and periodic inspections (at appropriate intervals) of the pivot bracket assemblies on all Trans Aero Industries Model 90835 jumpseats installed on Boeing 737-300 through -500 series airplanes.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

Issue an airworthiness directive to require all operators of Boeing 737-300 through -500 series airplanes to replace the slide cover latch brackets on forward slide compartments with the type of slide cover latch brackets installed on the forward slide compartments of Boeing 737-600 through -900 series airplanes. (A-01-12)

Issue an airworthiness directive to require initial and periodic inspections (at appropriate intervals) of the pivot bracket assemblies on all Trans Aero Industries Model 90835 jumpseats installed on Boeing 737-300 through -500 series airplanes. (A-01-13)

Acting Chairman CARMODY and Members HAMMERSCHMIDT, BLACK, and GOGLIA concurred in these recommendations.

By: Carol J. Carmody
Acting Chairman

⁸ Appropriate intervals would allow early evidence of loose pivot bracket mounting bolts in the pivot bracket assembly to be detected before a failure occurs.