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National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: March 18, 1992

In reply refer to: A-92-11 thru -15

Honorable Barry L. Harris
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

On December 27, 1991, at 0750 local time, Scandinavian Airlines System (SAS) flight 751, a McDonnell Douglas MD-80, OY-KHO, experienced the failure of both engines at an altitude of around 2,000 feet, about 3 minutes after takeoff from Stockholm Arlanda International Airport, Sweden. Attempts to restart the engines were unsuccessful. During the emergency landing, the airplane struck several trees and a drainage ditch and broke into three sections, coming to rest in a snow-covered field. Of the 123 passengers and 6 crewmembers on board, 39 persons sustained minor injuries. The first officer and seven passengers were seriously injured.

A correlation of injuries with the fuselage damage is continuing; however, preliminary information provided by the medical adviser to the Swedish Board of Accident Investigation (SHK) indicates that nine passengers sustained blunt force trauma injuries. The passengers had assumed the brace position prior to ground impact.

The passenger cabin was examined by the SHK with the assistance of the National Transportation Safety Board, the Federal Aviation Administration (FAA), Douglas Aircraft Company, and C&D Interiors, which manufactured the overhead cabin stowage bins. The passenger service units (PSU), which were fastened to the underside of the bins, contained the passenger supplemental oxygen generators and oxygen masks, ventilation air vents, and reading lights. The PSUs are secured to the underside of the bins with two hinges on the outboard side and a fitted grooved track on the inboard side. The examination revealed that several of the bins had separated from their anchorage points along the cabin wall. Additionally, PSUs became detached from their inboard edges and fell, stiking the heads of passengers. PSUs above the overwing emergency exits at rows 18 and 19 were hanging down, partially obstructing access to the exits. Other PSUs had separated from their stowage bins and were found in the cabin aisle. Oxygen generators mounted on the PSUs could have caused severe burn injuries to the passengers and/or been an ignition source.

About 70 percent of the bin doors had damaged latch lock plates (striker plates) or plates that were missing from their attachment points on the bin doors. Passengers stated that the carry-on luggage in the overhead bins was thrown throughout the cabin during the impact sequence. Most cabin floor panels were intact, and the passenger seats were secured to their floor tracks. The sides of the forward galley's compartments, which contained beverage carts, were displaced forward slightly. This damage was probably the result of flexing of the floor panels. The Safety Board believes that the minor damage to the cabin furnishings indicates that the vertical dynamic inertia loads were probably equal to or less than the minimum 6 G vertical static loads specified under 14 CFR 25.561 for the cabin floor and seats. This demonstrates that current static load test requirements do not adequately replicate the multidirectional dynamic load forces which occur in real world situations.

The issue of secure overhead bins was addressed as recently as November 20, 1991, when the FAA issued the proposed Airworthiness Directive (AD) (Docket No. 91-NM-171-AD) for certain B-737 and B-757 series airplanes. The proposed AD would require the reinforcement of the overhead stowage bins and the replacement of certain drag link and tie rod assemblies. The basis for this AD was the accident involving a British Midland Airways B-737-400 on January 8, 1989, near Kegworth, Leicestershire, England.[1] The Air Accident Investigation Branch (AAIB) concluded that: "A notable feature of the aircraft wreckage was that all but one of the overhead stowage bins had become detached in the impact and that they had done so in a very similar manner." The report further concluded that "Although it was not possible to determine the actual mass and distribution of passenger belongings in overhead bins, the results of the 1981-82 Civil Aviation Administration (CAA) survey indicated that the manufacturer's design and certification figure (3 pounds per inch of bin length) was generously conservative."

The AAIB recommended that certification for overhead stowage bins requires that the bins "remain attached to the fuselage structure when subjected to dynamic crash pulses substantially beyond the static load factors currently required." The FAA and Joint Airworthiness Requirements are for static load tests only and do not address dynamic load tests of stowage bins.

On January 15, 1992, static load tests were conducted under the direction of the Safety Board at the C&D Interiors facility in Huntington Beach, California. Representatives from the FAA Certification Service, Douglas Aircraft Company, and C&D Interiors witnessed the tests. A single bin was subjected to 15 static load tests in which lead weights were progressively added. The stowage bin withstood a 16 G static load, which was between 2,800 and 3,200 pounds, at which time it failed. When the

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[1] The Department of Transport, "Report on the Accident of Boeing 737-400, G-OBME, near Kegworth, Leicestershire, England, on January 8, 1989," Report 4/90.

plates fractured and the center bottom of the bin collapsed downward. Also, the rail that would have secured a PSU to the underside of the bin twisted downward under the load, thereby enlarging the opening into which a PSU would be fitted. The damage sustained by the test bin was not comparable to that evident in the accident airplane. This finding strongly suggests that the dynamic multiaxis inertia forces of the impact sequence caused the bins to separate at their attachments, the door striker plates to fail and the doors to open, and the PSUs to fall or separate entirely from the bins. The Safety Board believes that this situation is an unacceptable threat to occupant survival and safety in a survivable crash impact and that stowage bins and PSUs should remain firmly attached and unopened.

The FAA recently conducted static and dynamic tests of overhead stowage bins at the Transportation Research Center in Ohio. The tests found that the bins on some models of the B-737 and B-757 could not withstand the 9 G static longitudinal load. Dynamic tests of stowage bins were conducted using a cabin mockup mounted on a test sled. Preliminary data collected during static and dynamic tests using the same G load showed a significant difference in the ability of stowage bins to remain secured to wall attachments. During the dynamic tests, the bins detached from the cabin wall, whereas during the same static G load test, they remained secured. A report of the findings is expected to be released by the FAA in the spring of 1992.

The Safety Board believes that the dynamic tests of the stowage bins closely replicate the inertia forces of emergency landings. . The findings can be the basis for the requirement in 14 CFR 25 for dynamic tests of overhead stowage bins in order to accurately reflect crash forces.

In 1981, the Safety Board issued a special study on cabin safety,[2] in which the Safety Board recommended that the FAA:

> Establish and specify in the appropriate subpart of 14 CFR 25, interim standards for the design of seat and restraint systems and cabin furnishings to withstand the multiaxis acceleration levels such as those described by Simula Inc., in its Paper TI-8017. (Class II, Priority Action) (A-81-141)

Since the issuance of this recommendation, the FAA has established dynamic performance standards for the new improved 16 G seats. However, no concomitant requirement has been issued for dynamic test standards for overhead stowage bins.

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

> Require that overhead stowage bins manufactured by C&D Interiors and installed in MD-80 series airplanes be modified

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[2] National Transportation Safety Board, Special Safety Study, "Cabin Safety in Large Transport Aircraft" (AAS-81-2, 1981).

to ensure that the bins remain secured to their anchorages, the bin doors remain closed, and that passenger service units remain attached to the bins during accidents in which survivable loads are applied to the three major axes in combination. (Class II, Priority Action) (A-92-11)

Review the design of the C&D Interiors overhead stowage bins that are installed in airplanes other than the MD-80, and order any corrective action that may be required, as cited in (A-92-11) (Class II, Priority Action) (A-92-12)

Amend the appropriate subparts of 14 CFR 25.561 to establish and require dynamic testing standards for overhead stowage bins and all bin component fixtures. (Class II, Priority Action) (A-92-13)

Require that transport category airplanes manufactured after a certain date be equipped with overhead stowage bins and component fixtures that meet the requirements of dynamic test standards. (Priority Action) (A-92-14)

Develop a timetable that will require the modification of all bins and component fixtures currently in service on transport category airplanes in order to meet the new dynamic tests standards as cited in A-92-13. (Class II, Priority Action) (A-92-15)

Acting Chairman COUGHLIN, and Members LAUBER, HART, HAMMERSCHMIDT, and KOLSTAD, concurred in these recommendations.

Susan M. Coughlin
Acting Chairman