

1081915



National Transportation Safety Board

Washington, D.C. 20594
Safety Recommendation

Date: March 15, 1988

In reply refer to: A-88-37 and -38

Honorable T. Allan McArtor
Administrator
Federal Aviation Administration
Washington, D.C. 20591

On March 12, 1986, after the illumination of a fire warning light on a Boeing 727-223 operated by American Airlines, Inc., the pilot declared an emergency, returned to Memphis International Airport, and landed the airplane without difficulty. During the emergency evacuation, the lower tube at the foot of the right rear door's evacuation slide was punctured, and the entire slide deflated. The exit was blocked by a flight attendant to prevent its use and the passengers were diverted to other available exits. The National Transportation Safety Board's investigation found that the puncture was caused by a high-heeled shoe. Fortunately, no serious injuries resulted from this slide failure. 1/

The Safety Board investigated a similar evacuation slide failure following a Republic Airlines Boeing 727-2M7, unscheduled precautionary landing as a result of a fire warning light on the No. 2 engine, at Greater Cincinnati International Airport in Covington, Kentucky, on May 17, 1984. 2/ During the evacuation, the slide at the forward right door was punctured by what was believed to be part of a passenger's shoe. The passenger who was on the evacuation slide at the time it failed fell to the ground and was seriously injured.

The damage to the slides in both accidents included punctures and tears to their sliding surfaces and to the inflated tube materials. The evacuation slide materials were examined by the Safety Board staff, who found they exceeded the requirements of Technical Standard Order (TSO) C69a, Emergency Evacuation Slides, Ramps, and Slide/Rafts, as follows: the tensile strength of the sliding surface materials exceeded the requirements by 37 to 75 percent, and the tear strength exceeded the requirements by 52 to 114 percent; also, the inflated tube material exceeded the tensile strength requirements by 6 to 23 percent and the tear strength by 96 to 245 percent.

TSO-C69a presently has requirements for minimum tensile and tear strengths, but the Safety Board notes that the TSO has no requirement for minimum puncture strength. However, the TSO does require the slide

... to be capable of resisting puncture and tearing of the sliding and supporting structures from objects normally carried or worn by passengers that could result in collapse of the device, prevent the device from performing its intended function, or both.

1/ For more detailed information, read Field Accident Brief No. 696 (attached).

2/ For more detailed information, read Field Accident Brief No. 5070 (attached).

The material strength requirements are the same for all areas of the slides; however, the Safety Board's investigations have shown that portions of evacuation slides require greater strength because they come in contact with the evacuees or with the environment.

The Safety Board believes the strength criteria for the sliding surface, walking surface, and inflated tube materials for slides and ramps manufactured in accordance with TSO-C69a should be reevaluated to take advantage of new materials and combinations of materials that will improve their resistance to damage. Further, the Safety Board believes that these materials should be tested in accordance with new procedures developed by the evacuation slide manufacturers, which would combine the puncture and tearing strength tests in one test. While some materials have demonstrated good puncture qualities, they have poor tearing strength. Likewise, some materials have good tearing strength but poor resistance to puncture. The inclusion of combined puncture and tearing strength tests into TSO-C69a would establish new minimum strength requirements that would improve the resistance of evacuation slides to damage during emergency evacuations.

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

Coordinate an industry working group to develop a combined puncture/tear test that can be used to establish new strength requirements for evacuation slide materials. (Class II, Priority Action) (A-88-37)

Revise Technical Standard Order C69a, Emergency Evacuation Slides, Ramps, and Slide/Rafts, to incorporate the new puncture/tear test criteria and the new puncture/tear material strength requirements. (Class II, Priority Action) (A-88-38)

BURNETT, Chairman, and LAUBER, NALL, and KOLSTAD, Members, concurred in these recommendations.


By: Jim Burnett
Chairman

Brief of Accident

File No. - 696 3/12/86 MEMPHIS, TN A/C Reg. No. N877AA Time (Lcl) - 0717 CST

-----Basic Information-----

Type Operating Certificate-AIR CARRIER - FLAG/DOMESTIC Aircraft Damage Injuries
 Name of Carrier -AMERICAN AIRLINES, INC. NONE Fatal 0 Serious 0 Minor 0 None 7
 Type of Operation -SCHEDULED, DOMESTIC, PASSENGER Fire Crew 0 Pass 0
 Flight Conducted Under -14 CFR 121 NONE Pass 0 1 1 61
 Accident Occurred During -CLIMB

-----Aircraft Information-----

Make/Model - BOEING 727-223 End Make/Model - P&W JT8D-9A ELT Installed/Activated - NO -N/A
 Landing Gear - TRICYCLE-RETRACTABLE Number Engines - 3 Stall Warning System - YES
 Max Gross Wt - 171500 Engine Type - TURBOFAN
 No. of Seats - 150 Rated Power - 14500 LBS THRUST

-----Environment/Operations Information-----

Weather Data - PATMAS Airport Proximity ON AIRPORT
 Wx Briefing - TELETYPE Last Departure Point MEMPHIS, TN
 Method - FULL Destination NASHVILLE, TN
 Completeness - VMC ATC/Airspace
 Basic Weather - UNK/NR Type of Flight Plan - IFR
 Wind Dir/Speed - 7.0 SM Type of Clearance - IFR
 Visibility - CLEAR Type Appch/Lnds - PRECAUTIONARY LANDING
 Lowest Sky/Clouds - NONE Type of Flight Plan - IFR
 Lowest Ceiling - NONE Type of Clearance - IFR
 Obstructions to Vision - NONE Type Appch/Lnds - PRECAUTIONARY LANDING
 Precipitation - NONE Type Appch/Lnds - PRECAUTIONARY LANDING
 Condition of Light - DAYLIGHT

-----Personnel Information-----

Pilot-In-Command ATP Medical Certificate - VALID MEDICAL-NO WAIVERS/LIMIT
 Certificate(s)/Retired(s) 8E LAND, ME LAND Flight Time (Hours) Total 11670 Last 24 Hrs - 8
 Age - 53 Months Since - 3 Make/Model - 5450 Last 30 Days - UNK/NR
 Biennial Flight Review - YES Aircraft Type - B-727 Instrument - UNK/NR Last 90 Days - 117
 Current - YES Multi-Eng - UNK/NR Rotorcraft - UNK/NR

-----Instrument Rating(s) - AIRPLANE

-----Narrative-----

AMERICAN AIRLINES FLIGHT 502 EXPERIENCED A FIRE WARNING LIGHT ILLUMINATION ON NO. 1 ENGINE AS THE AIRCRAFT WAS CLIMBING THROUGH 6000 FEET. THE PILOT DECLARED AN EMERGENCY AND RETURNED TO MEMPHIS, FOLLOWING THE LANDING THE PILOT ORDERED A PASSENGER EVACUATION. DURING THE EVACUATION THE REAR SLIDE DEFLATED AFTER THE SLIDE MATERIAL WAS PUNCTURED. THE EXAMINATION OF THE MATERIAL DISCLOSED THAT THE PUNCTURE WAS THE RESULT OF A SHOE HEEL. THE EXAMINATION OF THE FIRE WARNING SYSTEM DISCLOSED THAT A DUCT CONNECTOR IN THE SYSTEM HAD FAILED. THE INJURY RECEIVED BY THE INJURED PASSENGER RESULTED FROM JUMPING OFF THE LEFT WING SURFACE DURING THE EVACUATION PHASE.

Brief of Accident (Continued)

File No. - 696 3/12/86 MEMPHIS, TN A/C Reg. No. N877AA Time (LCT) - 0717 CST

Occurrence MISCELLANEOUS/OTHER
Phase of Operation CLIMB

Findings(s)

1. FIRE WARNING SYSTEM, POWERPLANT - FAILURE, TOTAL
2. MISC EOP/FURNISHINGS, SLIDES - FAILURE, TOTAL
3. EMERGENCY PROCEDURE - NOT FOLLOWED - PASSENGER

-----Probable Cause-----

The National Transportation Safety Board determines that the Probable Cause(s) of this accident is/are findings(s) 3

Factor(s) relating to this accident is/are findings(s) 1, 2

Brief of Incident (Continued)

File No. - 5070

5/17/84

COVINGTON, KY

A/C Reg. No. N723RW

Time (Lcl) - 1723 EDT

Occurrence #1 AIRFRAME/COMPONENT/SYSTEM FAILURE/HALFJUNCTION
Phase of Operation CRUISE - NORMAL

Findings)

1. FIRE WARNING SYSTEM, POWERPLANT - SHORTEN
2. FIRE WARNING SYSTEM, POWERPLANT - FALSE INDICATION
3. FIRE EXTINGUISHING EQUIPMENT - SELECTED - PILOT IN COMMAND
4. FLIGHT TO ALTERNATE DESTINATION - PERFORMED - PILOT IN COMMAND
5. PRECAUTIONARY LANDING - PERFORMED - PILOT IN COMMAND

Occurrence #2 MISCELLANEOUS/OTHER
Phase of Operation STANDING - ENGINE(S) NOT OPERATING

Findings(s)

6. CREW/GROUP COORDINATION - INADEQUATE -
7. DOOR, EMERGENCY EXIT - OTHER
8. EMERGENCY EQUIPMENT - IMPROPER USE OF - OTHER CREW MEMBER

-----Probable Cause-----

The National Transportation Safety Board determines that the Probable Cause(s) of this incident is/are findings(s) 1, 2

Factor(s) relating to this incident is/are findings(s) 6, 8