



# National Transportation Safety Board

Washington, D.C. 20594

## Safety Recommendation

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**Date:** August 2, 2002

**In reply refer to:** A-02-20 through -23

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

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### Background

On November 20, 2000, about 1222 eastern standard time, a flight attendant/purser was killed during an emergency evacuation of American Airlines flight 1291, an Airbus Industrie A300B4-605R (A300), N14056, at Miami International Airport (MIA), Miami, Florida. The airplane was pressurized until the flight attendant/purser opened the left front (1L) emergency exit door; he was then forcibly ejected from the airplane. There were 133 persons on board. During the emergency evacuation, in addition to the 1 flight attendant/purser who was killed, 3 passengers sustained serious injuries; 18 passengers and 1 flight service director<sup>1</sup> sustained minor injuries; and the 2 pilots, 6 flight attendants, 1 off-duty flight attendant, 1 flight service director, and the remaining 100 passengers reported no injuries. The airplane sustained minor damage.<sup>2</sup>

The flight was operating as a 14 *Code of Federal Regulations* Part 121 scheduled international passenger flight. Visual meteorological conditions prevailed, and an instrument flight rules flight plan was filed. The flight departed MIA for Port Au Prince International Airport, Haiti, and had been airborne for about 8 minutes when the flight crew encountered a problem with the automatic pressurization system. The captain later stated to National Transportation Safety Board investigators that the automatic cabin pressurization controllers would not control cabin pressure when the airplane was climbing through 16,000 feet and that the electronic centralized airplane monitor (ECAM) display<sup>3</sup> indicated that the forward outflow

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<sup>1</sup> Flight service directors are language translators who are assigned to selected flights to assist flight attendants in communicating with passengers. Although flight service director training requires that they observe flight attendant emergency procedures training, they are not qualified as flight attendants.

<sup>2</sup> The description for this accident, MIA01FA029, can be found on the National Transportation Safety Board's Web site at <<http://www.ntsb.gov>>.

<sup>3</sup> The ECAM display is a cathode ray tube screen located in the cockpit. The system is automatic and displays messages and system diagrams to pilots. It provides operational assistance for both normal and abnormal airplane system situations.

valve<sup>4</sup> was fully open.<sup>5</sup> The cabin altitude was climbing at a rate of 2,000 feet per minute, and the cabin altitude indicator showed 7,000 feet. The captain decided to operate the pressurization system in the manual mode and, about 11 minutes after departure, indicated to air traffic control (ATC) that the flight would return to MIA. At that point, the pilots began performing the American Airlines A300<sup>6</sup> Cabin Pressurization Manual Control Checklist,<sup>7</sup> which is contained in the American Airlines A300 operating manual.

The captain stated to Safety Board investigators that during the return to MIA, the flight attendant call chimes sounded erratically, and the lavatory smoke detectors sounded continually. Passengers and cabin crewmembers complained about pressure in their ears. About 3 minutes before landing, the captain declared an emergency to ATC and requested that aircraft rescue and firefighting (ARFF) personnel stand by for the landing. After the airplane landed at MIA, ARFF personnel checked the exterior of the airplane and reported no signs of fire. The cockpit voice recorder (CVR) indicates that a flight attendant reported smelling smoke to the flight crew. The captain indicated to Board investigators that he observed the illumination of a “cargo loop light”<sup>8</sup> on the cockpit overhead panel. The captain then ordered an emergency evacuation of the airplane, and the American Airlines A300 Ground Evacuation Checklist<sup>9</sup> was performed.

The flight attendants heard the sounding of the evacuation signaling system and attempted to open the emergency exit doors to begin the emergency evacuation but were having difficulty doing so. One flight attendant requested and received assistance from a passenger to open the 3L emergency exit door, but the door could not be opened. Flight attendants at the 3L and 4L emergency exit doors then announced to passengers that their exits were blocked. A flight attendant reported to the flight crew that the doors would not open. While the flight attendant/purser was struggling to open the 1L emergency exit door of the airplane, the door suddenly burst open, and he was forcibly ejected onto the ramp and was killed. Preliminary findings from the investigation revealed that excess air pressure inside the cabin caused the door to burst open when the flight attendant/purser attempted to open it. After the 1L emergency exit door opened, all of the other emergency exit doors with handles in the open position opened, and the escape slides deployed. This accident investigation is ongoing.

During the Safety Board’s investigation of this accident, a similar accident occurred on October 20, 2001. In that accident, one flight attendant was killed and another flight attendant was seriously injured during the deplaning of TunisAir flight TAR631, an Airbus A300-605R, Tunisian registration TS-IPA, at Djerba Airport, Djerba, Tunisia. The flight was conducted as a

<sup>4</sup> The two outflow valves open and close during flight and on the ground to maintain control of cabin pressurization.

<sup>5</sup> At this point in flight, the valves would normally be over halfway closed. Postaccident examination of the airplane by the Safety Board’s Systems Group revealed that insulation blankets partially blocked the forward outflow valve and almost fully blocked the aft outflow valve.

<sup>6</sup> All A300 airplanes that American Airlines operates are A300-600 airplanes.

<sup>7</sup> The American Airlines A300 Cabin Pressurization Manual Control Checklist is similar to that of Airbus. The entire checklist cannot be performed at one time; rather, pilots must initiate the checklist and then complete it later in flight. According to the accident captain, he did not perform all of the items in the Cabin Pressurization Manual Control Checklist because of his other priorities at the time, including addressing the smoke indications and landing the airplane.

<sup>8</sup> Illumination of a light on the CARGO COMPT SMOKE DET panel may indicate a fire in the cargo compartment. No evidence of fire was found in the Safety Board’s postaccident examination of the airplane.

<sup>9</sup> The American Airlines A300 Ground Evacuation Checklist, which is contained in the American Airlines A300 operating manual, is similar to the Airbus A300-600 On Ground/Emergency Evacuation Checklist.

scheduled international passenger flight from Geneva, Switzerland, to Djerba. There were 2 flight crewmembers, 10 cabin crewmembers, and 134 passengers on board.

According to Airbus, on the flight to Geneva before the October 20, 2001, accident flight, the flight crew received an excessive cabin altitude warning and then placed the pressurization system in manual mode. The airplane landed safely at Geneva, and maintenance personnel inspected the airplane and found no anomalies. The airplane was then dispatched on the accident flight from Geneva to Djerba.

According to Airbus, while the flight was en route to Djerba, the flight crew again received an excessive cabin altitude warning and immediately placed the pressurization system in manual mode. The remainder of the flight and the landing at Djerba were uneventful. The airplane was parked at Djerba, and the engine bleed air was still turned on, allowing pressurized air into the airplane. While an air stair was being positioned to the 2L door of the airplane, a flight attendant attempted to open the 2L door. Excessive cabin pressure caused the door to burst open, and the flight attendant who opened the door was ejected and sustained serious injuries. A flight attendant who was standing near the flight attendant who opened the door was also ejected from the airplane and was killed.<sup>10</sup>

## **Discussion**

The type of overpressurization event<sup>11</sup> that occurred in these accidents could occur in any air carrier airplane equipped with doors of a similar design if it is not fully depressurized when the emergency exit doors are opened and if it is not equipped with systems on its emergency exit doors to relieve pressure. All transport-category aircraft have outflow valves that regulate pressure inside the cabin. If air is prevented from flowing through the outflow valves because of a command to close the valves or a blockage of the valves, this type of overpressurization event could occur again.

### Emergency Exit Door Design

During its investigation of the November 20, 2000, accident, the Safety Board examined the design of the Airbus A300 emergency exit doors. The Airbus A300 is equipped with eight emergency exits that have door stop fittings along each side of the door and fuselage stop fittings<sup>12</sup> along each side of the fuselage frame. (Figure 1 shows a picture of the November 20, 2000, accident airplane's emergency exit door that burst open. The door has been rotated in the doorframe because of damage sustained during the accident.) Opening the emergency exit door moves it sequentially upward, outward, and forward parallel to the fuselage. Upper and lower

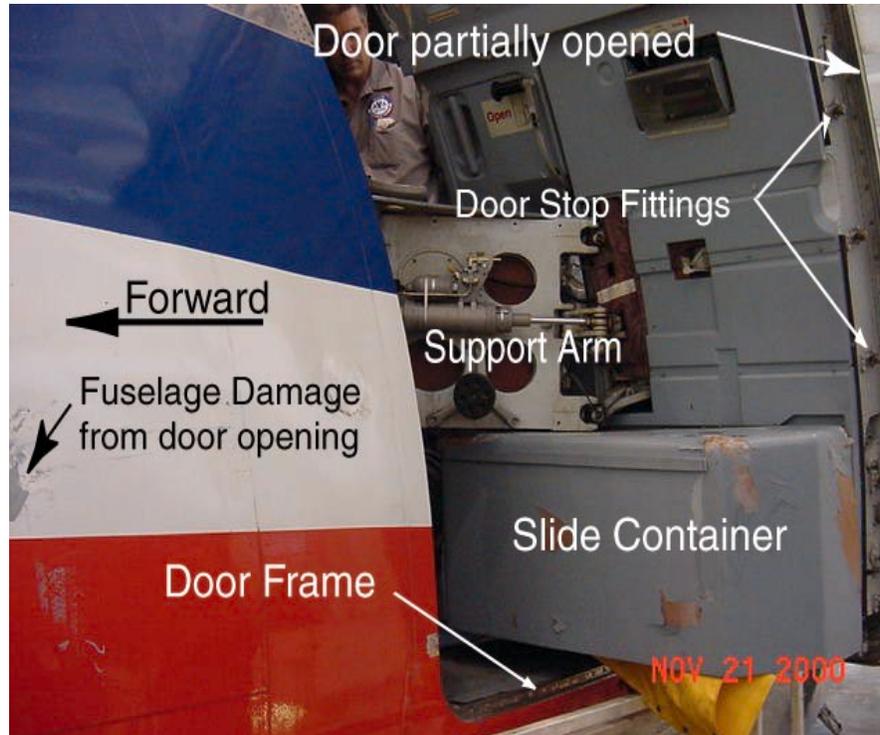
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<sup>10</sup> Two other occurrences of injuries that resulted from excessive cabin pressure were found in the National Aeronautics Space Administration Aviation Safety Reporting System. In one incident, a mechanic sustained a head injury when he opened a door on a pressurized ATR-72 from the outside. In the other incident, a flight attendant received minor injuries when she opened a cabin door on a pressurized Canadair CL65 Bombardier and was ejected from the airplane.

<sup>11</sup> The cabin is considered to be overpressurized when it is pressurized at a level that is higher than the intended pressure level for that phase of flight.

<sup>12</sup> A door stop fitting consists of a steel bolt and a stop pin, and a fuselage stop fitting consists of a steel tab. The door stop fitting pins along each side of the door must clear the top of the fuselage stop fittings when the door is opened.

connecting links attach a support arm to the door. The lower connecting link, a lifting lever, moves the emergency exit door up and over the fuselage stop fittings, and the door opens. Guide arms keep the door parallel to the fuselage. A damper/emergency operation cylinder powered by a gas bottle, which is mounted inside the emergency exit door's support arm, assists the forward movement of the door and slows its momentum so that it does not damage the adjacent fuselage when it opens. According to Airbus, a person of the same size and stature (183 pounds and 5 feet 10 inches tall) as the flight attendant/purser could exert enough force on the handle to open the emergency exit door even if the airplane is overpressurized. Airbus A300 emergency exit doors do not have built-in systems to relieve pressure before the door is opened.



**Figure 1. November 20, 2000, Accident Airplane's (Airbus A300) Emergency Exit Door.**

During its investigation of the November 20, 2000, accident, the Safety Board found that the 1L emergency exit door's lower guide arm was fractured and its support arm was cracked, consistent with the door bursting open because of excess pressure. The investigation also revealed that a section of each of the emergency exit door's aft eight door stop fitting pins was flattened, consistent with them having been forced up and over the fuselage stop fittings before the door burst open.

Some models of transport-category aircraft are equipped with systems to relieve pressure, such as vent doors or gates, on emergency exit doors. For example, in some cases, floor-level emergency exit doors are equipped with a vent door that is linked to the door handle and relieves cabin pressure to a safe level before the emergency exit door can be opened. The Safety Board is concerned that, on airplanes like the Airbus A300 that do not have pressure relief systems for their emergency exit doors, forcing open the doors when the airplane is overpressurized could result in events similar to those described earlier or in more serious events. The Board notes that if the emergency exit doors on the airplanes had been equipped with pressure relief systems, the

flight attendants would likely not have been able to open the doors until the pressure was relieved. The Board recognizes that pressure relief systems for emergency exit doors would depressurize an airplane slower than the opening of the outflow valves, which is the preferred method of depressurizing the airplane. However, even this slower rate of depressurization would provide some protection against injury or death associated with opening the door while the airplane is still pressurized. Further, if the November 20, 2000, accident airplane had pressure relief systems for its emergency exit doors, they may have depressurized the airplane at a faster rate than the flight crew's opening of the outflow valves, which were partially blocked.<sup>13</sup>

The Safety Board notes that some new production transport-category aircraft are not being equipped with emergency exit door pressure relief systems. The Board considers any pressure relief system that prevents the opening of emergency exit doors on overpressurized airplanes on the ground until a safe differential pressure level is attained<sup>14</sup> to be beneficial to safety. Therefore, the Safety Board believes that the Federal Aviation Administration (FAA) should require that all newly certificated transport-category airplanes have a system for each emergency exit door to relieve pressure so that they can only be opened on the ground after a safe differential pressure level is attained. Further, the Safety Board believes that for those transport-category airplane emergency exit doors that can be opened on the ground when the airplane is overpressurized, the FAA should require air carriers to provide specific warnings near the emergency exit doors (such as lights, placards, or other indications) that clearly identify the danger of opening the emergency exit doors when the airplane is overpressurized.

#### Flight and Cabin Crew Manuals and Training Programs

When the captain of American Airlines flight 1291 decided to return to MIA, he made a public address (PA) announcement to the flight attendants and passengers that the flight was returning to MIA because of a problem with the airplane's air conditioning system. No mention was made of pressurization problems during the PA announcement. In addition, flight crewmembers were unaware that the airplane was overpressurized when they signaled the flight attendants to begin the emergency evacuation. Flight attendants were also unaware that the airplane was overpressurized when they responded to the evacuation signal.

Several of the flight attendants reported after the accident that they were unsure why their doors would not open during the emergency evacuation. However, the flight attendant at the 4R emergency exit door indicated to Safety Board investigators in a postaccident interview that when she had worked for another air carrier, she observed a pressurization test of an airplane and learned that the emergency exit doors would not open when the airplane was overpressurized on the ground. She stated that, on the accident airplane, she pulled "up on the door handle and it went about 1/2 way up and then...put it back down." She indicated that she informed the flight attendants at the 4L emergency exit door that they would not be able to open their emergency exit doors because the airplane was not depressurized, and they both ceased trying to open their doors.

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<sup>13</sup> Although the flight crew's manual opening of the outflow valves would likely have allowed the airplane to depressurize, the depressurization would have occurred at a rate that is substantially slower than normal because of the partial blockage of the valves' openings.

<sup>14</sup> Differential pressure, indicated by a cabin differential pressure gauge on the pressurization panel in the cockpit, is the difference between the pressure inside the airplane and that outside of the airplane.

One of the flight service directors standing at the 1R flight attendant jumpseat stated that the flight attendant/purser tried to open the 1L emergency exit door using one hand on the door handle and the other hand on the handhold by the side of the door but was unable to do so. The flight attendant/purser told the flight service director that something was wrong, entered the cockpit, and then returned to the cabin. The CVR indicates that, approximately 40 seconds before the event, the flight attendant/purser made a comment about pressurization. The flight service director then noticed the flight attendant/purser try to open the 1L emergency exit door using both hands on the door handle. The 1L emergency exit door then burst open, forcibly ejecting the flight attendant/purser from the airplane.

The flight attendants on the November 20, 2000, accident flight were trained in accordance with the emergency evacuation procedures in the American Airlines Flight Attendant Safety Manual, which provides guidance for all airplanes operated by American Airlines. The manual instructs flight attendants to evacuate the airplane immediately “upon signal from the cockpit” and to “assess conditions” for danger outside of the airplane before opening their emergency exit doors. The manual does not address a situation in which all of the emergency exit doors fail to open during an evacuation and does not instruct flight attendants on recognizing the signs of an overpressurized cabin. In addition, FAA Cabin Safety Specialists reported to the Safety Board that the flight attendant safety manuals and training programs of 12 air carriers, including American Airlines, do not include information about how to recognize the signs of an overpressurized airplane.<sup>15</sup> Further, the American Airlines flight crew operating manual and training program also do not include information about recognizing the signs of an overpressurized airplane.

The Safety Board is concerned that because of this lack of information about the signs of an overpressurized airplane on the ground, flight and cabin crewmembers might not recognize the signs of an overpressurized airplane.<sup>16</sup> The Board notes that if the flight attendants had been trained to recognize signs of overpressurization, the flight attendant/purser would not likely have attempted to forcibly open the 1L emergency exit door. Further, the Board recognizes the need for information about the signs of overpressurization and exit operation for flight and cabin crewmembers regardless of whether the airplane is equipped with pressure relief systems on its emergency exit doors. Therefore, the Safety Board believes that the FAA should review all air carriers’ flight and cabin crew training manuals and programs and require revisions, if necessary, to ensure that they contain information about the signs of an overpressurized airplane on the ground and the dangers of opening emergency exit doors while the airplane is overpressurized.

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<sup>15</sup> Signs of an airplane that has not been depressurized on the ground may include a hissing sound around the exits and failure of the exits to open when normal forces are exerted on the exit handle.

<sup>16</sup> On May 8, 2001, the Safety Board issued Safety Recommendations A-01-16 through -22 to the FAA regarding information contained in the Airbus Industrie A300-600 operating manual and checklists and A300-600 operators’ operating manuals, checklists, and training programs. Safety issues included the adequacy of information regarding depressurization of the airplane when the pressurization system is being operated in the manual mode; the need for the flight crew to verify that the cabin differential pressure is 0 pounds per square inch (psi) before signaling the flight attendants to begin an emergency evacuation; and the need for the flight crew to verify that the cabin differential pressure is 0 psi before permitting the flight attendants or gate agents to open the cabin doors. In a January 23, 2002, letter to the FAA, the Board classified Safety Recommendations A-01-16, -17, and -20 “Open—Acceptable Response” and Safety Recommendations A-01-18, -19, -21, and -22 “Open—Unacceptable Response.”

Further, the Safety Board believes that the FAA should require that cabin crew training manuals and programs contain procedures to follow during an emergency evacuation when the airplane is overpressurized.

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

Require that all newly certificated transport-category airplanes have a system for each emergency exit door to relieve pressure so that they can only be opened on the ground after a safe differential pressure level is attained. (A-02-20)

For those transport-category airplane emergency exit doors that can be opened on the ground when the airplane is overpressurized, require air carriers to provide specific warnings near the emergency exit doors (such as lights, placards, or other indications) that clearly identify the danger of opening the emergency exit doors when the airplane is overpressurized. (A-02-21)

Review all air carriers' flight and cabin crew training manuals and programs and require revisions, if necessary, to ensure that they contain information about the signs of an overpressurized airplane on the ground and the dangers of opening emergency exit doors while the airplane is overpressurized. (A-02-22)

Require that cabin crew training manuals and programs contain procedures to follow during an emergency evacuation when the airplane is overpressurized. (A-02-23)

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

*Original Signed*

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Chairman