Pressurization problems and emergency landing, Airbus Industrie A300B4-605R, November 20, 2000

Micro-summary: This Airbus Industrie A300B4-605R experienced pressurization problems resulting in many spurious alarms, and a diversion back to the airport, evacuation, and fatal injuries to a flight attendant.

Event Date: 2000-11-20 at 1222 EST

Investigative Body: National Transportation Safety Board (NTSB), USA

Investigative Body's Web Site: http://www.ntsb.gov/

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1. Accident reports can be and sometimes are revised. Be sure to consult the investigative agency for the latest version before basing anything significant on content (e.g., thesis, research, etc).

2. Readers are advised that each report is a glimpse of events at specific points in time. While broad themes permeate the causal events leading up to crashes, and we can learn from those, the specific regulatory and technological environments can and do change. ***Your company's flight operations manual is the final authority as to the safe operation of your aircraft!***

3. Reports may or may not represent reality. Many many non-scientific factors go into an investigation, including the magnitude of the event, the experience of the investigator, the political climate, relationship with the regulatory authority, technological and recovery capabilities, etc. It is recommended that the reader review all reports analytically. Even a "bad" report can be a very useful launching point for learning.

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National Transportation Safety Board

FACTUAL REPORT AVIATION

NTSB ID: MIA01FA029	Aircraft Registration Number: N14056
Occurrence Date: 11/20/2000	Most Critical Injury: Fatal
Occurrence Type: Accident	Investigated By: NTSB

Location/Time

Nearest City/Place	State	Zip Code	Local Time	Time Zone	
MIAMI	FL	33159	1222	EST	

Airport Proximity: On Airport	Distance From Landing Facility: 0.5	Direction From Airport: 270

Aircraft Information Summary

Aircraft Manufacturer	Model/Series	Type of Aircraft
Airbus Industrie	A300B4-605R	Airplane

Sightseeing Flight: No Air Medical Transport Flight: No

Narrative

Brief narrative statement of facts, conditions and circumstances pertinent to the accident/incident:

HISTORY OF FLIGHT

On November 20, 2000, about 1222 eastern standard time, an Airbus Industrie A300B4-605R, N14056, registered to Wilmington Trust Company, and operated by American Airlines, Inc., as flight 1291, a Title 14 CFR Part 121 scheduled international passenger flight, from Miami, Florida, to Port Au Prince, Haiti, had a flight attendant receive fatal injuries during an emergency evacuation after the flight returned to Miami. Visual meteorological conditions prevailed at the time and an instrument flight rules flight plan was filed. The aircraft received minor damage and the airline transport-rated pilot, first officer, 5 flight attendants, 3 other crewmembers, and 100 passengers were not injured. One flight attendant received fatal injuries, 3 passengers received serious injuries, and 1 flight attendant and 18 passengers received minor injuries. The flight originated from Miami, Florida, the same day, about 1149.

According to American Airlines, Inc. records, the captain reported for the accident flight at 1010 and the first officer reported at 1020. The flight crew received departure paperwork for the flight that included airplane information, weight and balance information, NOTAMS and weather information. Flight 1291 departed the gate at 1120 and was airborne at 1149. The first officer was the pilot flying.

At 1156, during the climb to flight level 230, at about 16,000 feet above mean sea level (msl), the captain stated to the copilot that the airplane was depressurizing and for him to get the airplane down. The first officer disconnected the autopilot and began a descent. The flight crew notified Miami Air Route Traffic Control Center of a pressurization problem and requested a descent to 10,000 feet. Miami Center cleared flight 1291 to descend to 10,000 feet. The captain switched to manual pressurization control. At about 1159, after leveling at 10,000 feet, the flight crew advised the controller that they were unable to control pressurization and requested a clearance to return to Miami. The controller assigned a heading of 115 degrees and instructed the flight crew to contact Miami Approach Control.

At about 1214, after being cleared to land by the Miami Air Traffic Control Tower, the captain declared an emergency, requested fire equipment to stand-by and stated to the tower controller: "we are getting some warnings of a fire, although there is no evidence of a fire at this time." Flight 1291 landed in Miami at about 1218. Total flight time for this abbreviated flight segment was 29 minutes.

Shortly after landing, the airplane stopped on the taxiway and the flight crew requested fire personnel to inspect the exterior of the airplane for any visible evidence of fire. At about 1220, after being cleared to taxi to the ramp, a flight attendant called the captain on the intercom and reported a smell of smoke in the middle lavatory. She said it smelled like rubber burning. Immediately following this communication, the captain stated that he noticed that one of the cargo

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compartment fire detection loop lights was illuminated. He informed the ground controller, "we have a fire and we are going to evacuate right here."

The flight attendants experienced difficulty opening the cabin doors when the emergency evacuation was initiated. The captain was notified of this difficulty. While the captain was evaluating the problem, he said he heard a "whoosh" sound and then the cabin doors opened, emergency slides deployed and passengers evacuated the airplane.

At the captain's command to evacuate, the purser went to the L1 door and tried to open it, using one hand. The door would not open. The purser went back to the cockpit to tell the flight crew. The purser then came out of the cockpit and tried to open the door using both hands. He also heard someone from the back of the airplane state that the doors were not opening. Also, the number three and number four flight attendants stated their doors would not open. He was watching the purser out of the corner of his eye when all of a sudden there was an explosion. He was being pulled toward the L1 door and hit the corner of the lavatory and the L1 jump seat. He fell to the floor and blacked out momentarily. When he awoke the L1 door was open and the purser was on the ground about 60 feet from the airplane.

PERSONNEL INFORMATION

The captain held an Airline Transport Pilot certificate last issued on May 2, 1996, with airplane multiengine land, and instrument airplane ratings. He also held type ratings in the Airbus A-300B4-605R/A-310, Boeing 757 and 767, and Lockheed 300. At the time of the accident, the captain held an Federal Aviation Administration (FAA) first class medical certificate dated June 15, 2000. American Airlines hired the captain on February 8, 1985. A review of FAA records found no accident, incident or enforcement action. The captain last received a proficiency check in the Airbus A-300B4-605R on October 24, 2000.

The first officer held an FAA Airline Transport Pilot certificate last issued on June 22, 1999, with airplane single engine land, airplane multiengine land, rotorcraft helicopter, and instrument airplane and helicopter ratings. He also held type ratings in the A-300B4-605R/A-310 and the Lockheed L-382. At the time of the accident, the first officer held an FAA first class medical certificate dated, May 31, 2000, with no restrictions. American Airlines hired the first officer on June 29, 1998. A review of FAA records found no accident, incident or enforcement action. The first officer last received a proficiency check in the Airbus A-300B4-605R on June 13, 2000.

AIRPLANE INFORMATION

The airplane was an Airbus Industrie A-300B4-605R, serial number 463, U.S. registration N14056, manufactured in 1988. The airplane was equipped with two General Electric CF6-80C2A5 engines, which are rated at 61,500 pounds of takeoff thrust each. At the time of the accident, the airplane had accumulated 34,346 total flight hours.

Logbook records show the airplane was last inspected on September 28, 2000, 345 flight hours before the accident, when the airplane received a "B" check in accordance with the American Airlines continuous airworthiness program. On November 9, 2000, the aft pressurization outflow valve was changed.

WEIGHT AND BALANCE

The following information was obtained from the flight departure paperwork:

Basic Operating Weight	206669 lbs.
Passenger Weight	21780 lbs.

Narrative (Continued)

Baggage Weight	11177	lbs.
Zero Fuel Weight		239626 lbs.
Maximum Zero Fuel Weight Allowed		288800 lbs.
Fuel	55600	lbs.
Ramp Weight	296626	lbs.
Maximum Ramp Weight Allowed	380500	lbs.
Taxi Fuel Burn	1400	lbs.
Actual Takeoff Weight	295226	lbs.
Maximum Takeoff Weight Allowed	323800	lbs.
Estimated Fuel Burn to PAP		18965 lbs.
Estimated Landing Weight		267000 lbs.
Maximum Landing Weight Allowed	308600	lbs.

Takeoff center of gravity (CG) was 26.1 percent of the mean aerodynamic chord (MAC) and was within the approved limits of the airplane.

METEOROLOGICAL INFORMATION

The Miami International Airport 1238 surface weather observation was winds from 330 degrees at 8 knots, visibility 10 statute miles, clouds scattered at 2,500 feet above ground level, temperature 83 degrees F, dew point temperature 70 degrees F, altimeter setting 30.09 inches Hg. Visual meteorological conditions prevailed at the time.

FLIGHT RECORDERS

The cockpit voice recorder (CVR) was a Fairchild model A-100A s/n 50909. The CVR was brought to the audio laboratory of the National Transportation Safety Board (NTSB) on November 21, 2000. The CVR Group convened on November 29, 2000. A transcript was prepared of the entire 30:59-minute recording.

The solid state flight data recorder (FDR), Fairchild model FA2100 (serial number 00857), was removed from the aircraft and sent to the National Transportation Safety Board's laboratory in Washington, D.C. for readout and evaluation. A successful FDR readout was performed.

WRECKAGE AND IMPACT INFORMATION

The outflow valves and the compartments in which the outflow valves are located were inspected shortly after the accident for any signs of discrepancies which might have caused the pressurization problems reported by the flight crew. The aft outflow valve was noted to be in the fully closed position, and the forward outflow valve was in the 1/4 to 3/8 open position. Closer inspection of the aft outflow valve found that an insulation blanket was obstructing the intake side of the valve, and the blanket was drawn through the intake screen in some areas. Marks indicated the insulation blanket at sometime had blocked the butterfly of the outflow valve. In addition, many of the insulation blankets in the compartment containing the aft outflow valve were displaced from their proper positions and were not secured in place. Closer inspection of the forward outflow valve found that an insulation blanket was partially obstructing the intake side of that valve. This insulation blanket had impressions on it that were of the same size and shape as the complete intake grill. Inspection of the compartment containing the forward outflow valve and the forward cargo compartment found that many of the insulation blankets in these compartments were displaced from their proper positions and were not secured in place.

All seven of the aircraft's lavatories were inspected to look for any signs of smoke or fire. The lavatories' waste bins, water heaters, and overhead spaces were all checked and no signs of soot or fire were found. A cigarette was found at the bottom of the waste bin for lavatory Y. All of the galleys on the aircraft were inspected to look for any signs of smoke or fire. All of the ovens,

Narrative (Continued)

waste containers, and food storage areas were inspected, and no signs of soot or fire were found. All of the cargo compartments on the aircraft were inspected for any signs of smoke or fire. All of the areas around the smoke detectors as well as other areas inside the cargo compartments and behind the cargo compartment walls were inspected, and no signs of soot or fire were found.

MEDICAL AND PATHOLOGICAL INFORMATION

Postmortem examination of the flight attendant who received fatal injuries during the emergency evacuation of the aircraft was performed by the Miami-Dade County Medical Examiner's Office. The cause of death was attributed to multiple blunt force injuries. Postmortem toxicology studies on specimens obtained from the fatally injured flight attendant was performed by the Miami-Dade County Medical Examiner's Office. The tests were negative for volatiles in chest blood and drugs in urine.

Post-accident toxicology testing on specimens obtained from the captain, first officer, six surviving flight attendants, and two flight service directors were negative for alcohol and drugs.

FIRE

There was no fire onboard the airplane in flight or after landing.

TESTS AND RESEARCH

The flight crew switched control of the pressurization system to the manual mode when they noticed a malfunction of the system during climb. The American Airlines, Inc., A-300 Operating Manual contains a procedure on page Air 5 of the Emergency/Abnormal Section, which the flight crew should follow after switching to manual control of the pressurization system. The procedure calls for the vertical speed control to be moved to the up or outflow valve full open position before landing. Also, the procedure calls for air conditioning packs 1 and 2 to be turned off on the ground and for the flight crew to check that the pressure differential of the airplane is zero before the doors are opened. A warning note on the page states: "On the ground both packs are selected off to ensure depressurization." The captain's A-300 Operating Manual was found open to this page after the accident. The flight crew stated that they did not complete the procedure for switching to manual pressurization. The forward outflow valve was found in the 3/8-open position and the aft outflow valve was found in the fully closed position after the accident.

The American Airlines A-300 Operating Manual contains a procedure on pages 4 and 5 of the Emergency/Abnormal Section, for Emergency Landing. The procedure lists "recommended actions before landing." Item 8 states, "Depressurize airplane and press Pack Switches Off. Ascertain that the differential pressure gauge reads zero." The flight crew stated they did not have time to complete this procedure because they were on final approach when the captain declared an emergency.

The American Airlines A-300 Operating Manual also contains the A-300 Emergency Procedures Checklist on pages 11 and 12. The Emergency Procedures Checklist contains a "Ground Evacuation" procedure. The "Ground Evacuation" procedure is also displayed on each pilot control wheel. The "Ground Evacuation" procedure does not call for the flight crew to check the differential pressure prior to commanding an emergency evacuation. The flight crew stated they did perform this checklist.

The flight crew's performance of the "Ground Evacuation" procedure required the crew to press in the RAM AIR switch. The American Airlines Computer-Based Training syllabus advises that "when the ram air switch is pressed in, the green "open" light illuminates, indicating that the ram air inlet is fully open to permit unrestricted ventilation, and also that both outflow valves are open." American Airlines' manuals replicate Airbus Industrie's operation and system description manuals concerning outflow valve operation. However, Airbus Industrie's manuals did not advise that the outflow valves will not move to a full open position when the RAM AIR switch is pressed in while in manual pressurization mode. The flight crew stated that upon selection of the RAM AIR switch

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during performance of the Emergency Evacuation Checklist, the illumination light indicated "OPEN." The flight crew was not aware that the RAM AIR switch would not open the outflow valves if the pressurization system was being operated in manual mode.

During the accident flight, the flight crew reported that the lavatory smoke alarms sounded and an aft cargo compartment loop fault light came on. The lavatory smoke alarms all operate independently of each other, while the cargo compartment smoke detectors work in pairs. A cargo compartment loop light indicates that one of the two cargo compartment smoke detectors in that loop has detected smoke but the other detector has not. This indication can be due to a malfunctioning detector or an actual fire. All of the smoke detectors that sounded their alarms during the accident flight were of the ionization type. During post-accident testing, all of the detectors could be made to sound their alarms, without smoke present, when subjected to abnormal pressure levels.

The pressurization control system is a fully automatic, electrically operated system. It consists of two identical independent automatic systems operating two outflow valves, one situated forward of the air conditioning bay and the other aft of the bulk cargo compartment. Each valve is operated by one of three electric motors; two of these motors are controlled independently by the two automatic systems, and the third motor (for the manual system) is controlled by a toggle switch located on the overhead panel in the flight compartment. In each valve, the drive mechanism and butterfly valve are common to either system, and the two automatic systems will alternately operate both valves. Each system is used alternately for each flight, the changeover being affected automatically between flights. In the event of a system failure, control is automatically transferred to the other system. The system function is dependent on pre-programmed cabin pressure altitude, aircraft altitude, and pre-selected landing altitude information. This information is relayed to the pressurization controller of either of the two systems selected. These units also automatically control pre-pressurization and depressurization procedures.

The cabin pressure controllers, mounted in the avionics compartment, are electronic devices intended to optimize the pressure build-up in the cabin while minimizing pressure fluctuations. In automatic mode, the controllers monitor and control cabin pressure automatically during all phases of flight. After landing (main landing gear compressed), the automatic mode commands the outflow valves to a fully open position 45 seconds after touchdown. When the cabin pressure is being controlled in manual mode, the outflow valves do not open automatically after touchdown.

The cabin altimeter was exposed to increased pressure to determine at what value of increased pressure the indicator would read 20,000 ft. This value was found to be 1351.9 mb (40.03 in. Hg or 19.61 psia). Disassembly of the unit showed unit design did not include any mechanical pointer stops.

Examination of the insulation blankets that were loose and had moved over the intakes of the forward and aft outflow valves showed that they were not the original blankets supplied with the airplane. According to American Airlines, the blankets were manufactured by American Airlines under the authority provided by CFR 14, 121.363 and 21.303b. Blankets nearest the forward outflow valve, which incorporated additional security incorporated by the airline, remained in place. Both compartments contained a mix of Airbus-and American Airlines-manufactured insulation. The American Airlines-manufactured insulation blankets did not have fasteners for securing the insulation blankets as recommended in Airbus data.

According to an e-mail from the FAA Seattle Aircraft Evaluation Group Program Manager for the A300 aircraft (Airworthiness), the A-300 and A-310 principal maintenance inspectors were informed of this accident and reported that of all U.S. operators, only American Airlines reported finding loose insulation blankets in their aircraft. American Airlines reported that four of their 33 aircraft inspected had loose blankets.

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A review of records by U.S. Customs and American Airlines show no record that U.S. Customs Inspectors performed an inspection of the accident airplane between November 9, 2000, when the aft outflow valve was changed, and the time of the accident.

ADDITIONAL INFORMATION

The accident airplane was released by the NTSB to John Darbo, American Airlines Flight Safety Department, on December 6, 2000. Components retained by the NTSB for further investigation were later released to American Airlines.

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Occurrence Type: Accident

Landing Facility/Approach Information

Airport Name	Airport ID:	Airport Elevation	Runway Used	Runway Length	Runway Width
Miami International	KMIA	8 Ft. MSL	30	9354	150

Runway Surface Type: Asphalt

Runway Surface Condition: Dry

Type Instrument Approach: ILS-localizer Only

VFR Approach/Landing: None

Aircraft Information

Aircraft Manufacturer	Model/Series	Serial Number
Airbus Industrie	A300B4-605R	463

Airworthiness Certificate(s): Transport

Landing Gear Type: Retractable - Tricycle

Homebuilt Aircraft?	Number of Seats:	Certified Max Gross Wt.	Number of Engines:
No	281	323800 LBS	2

Engine Type:	Engine Manufacturer:	Model/Series:	Rated Power:
Turbo Fan	General Electric	CF6-80C2A5	61500 LBS

- Aircraft Inspection Information

Type of Last Inspection	Date of Last Inspection	Time Since Last Inspection	Airframe Total Time
Continuous Airworthiness	09/2001	345 Hours	34346 Hours

- Emergency Locator Transmitter (ELT) Information

ELT Installed?	ELT Operated?	ELT Aided in Locating Accident Site?
Yes	No	No

Owner/Operator Information

Registered Aircraft Owner	Street Address	City	State	Zip Code
Wilmington Trust Company	Rodney Square North	Wilmington	DE	19890

Operator of Aircraft	Street Address	City	State	Zip Code
AMERICAN AIRLINES	4333 Amon Carter Blvd.	Fort Worth	TX	75261

Operator Does Business As:

Operator Designator Code: AALA

- Type of U.S. Certificate(s) Held:

Air Carrier Operating Certificate(s): Flag Carrier/Domestic

Operating Certificate:

Operator Certificate:

Regulation Flight Conducted Under: Part 121: Air Carrier

Type of Flight Operation Conducted: Scheduled; International; Passenger Only

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Occurrence Type: Accident

First Pilot Information

Name	City	State	Date of Birth	Age
On File	On File	On File	On File	44

Sex: M | Seat Occupied: Left | Principal Profession: Civilian Pilot | Certificate Number: On File

Certificate(s): Airline Transport; Flight Engineer

Airplane Rating(s): Multi-engine Land

Rotorcraft/Glider/LTA: None

Instrument Rating(s): Airplane

Instructor Rating(s): None

Type Rating/Endorsement for Accident/Incident Aircraft? Yes | Current Biennial Flight Review? 10/2000

Medical Cert.: Class 1 | Medical Cert. Status: Valid Medical--no waivers/lim. | Date of Last Medical Exam: 06/2000

- Flight Time Matrix	All A/C	This Make and Model	Airplane Single Engine	Airplane Mult-Engine	Night	Instrument Actual	Instrument Simulated	Rotorcraft	Glider	Lighter Than Air
Total Time	13043	4650								
Pilot In Command(PIC)	8612									
Instructor										
Last 90 Days	135									
Last 30 Days	48									
Last 24 Hours	7									

Seatbelt Used? Yes | Shoulder Harness Used? Yes | Toxicology Performed? Yes | Second Pilot? Yes

Flight Plan/Itinerary

Type of Flight Plan Filed: IFR

Departure Point	State	Airport Identifier	Departure Time	Time Zone
Same as Accident/Incident Location		MIA	1149	EST

Destination	State	Airport Identifier
PORT AU PRINCE		MTPP

Type of Clearance: IFR

Type of Airspace: Class D

Weather Information

Source of Briefing: Company

Method of Briefing: Telephone

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Weather Information

WOF ID	Observation Time	Time Zone	WOF Elevation	WOF Distance From Accident Site	Direction From Accident Site
MIA	1238	EST	8 Ft. MSL	1 NM	90 Deg. Mag.

Sky/Lowest Cloud Condition: Scattered 2500 Ft. AGL

Condition of Light: Day

Lowest Ceiling: None Ft. AGL

Visibility: 10 SM

Altimeter: 30.09 "Hg

Temperature: 28 °C

Dew Point: 21 °C

Wind Direction: 330

Density Altitude: 1300 Ft.

Wind Speed: 8

Gusts:

Weather Condtions at Accident Site: Visual Conditions

Visibility (RVR): 0 Ft.

Visibility (RVV) 0 SM

Intensity of Precipitation:

Restrictions to Visibility: None

Type of Precipitation: None

Accident Information

Aircraft Damage: Minor

Aircraft Fire: None

Aircraft Explosion None

Classification: U.S. Registered/U.S. Soil

- Injury Summary Matrix	Fatal	Serious	Minor	None	TOTAL
First Pilot				1	1
Second Pilot				1	1
Student Pilot					
Flight Instructor					
Check Pilot					
Flight Engineer					
Cabin Attendants	1		1	5	7
Other Crew				3	3
Passengers		3	18	100	121
- TOTAL ABOARD -	1	3	19	110	133
Other Ground	0	0	0		0
- GRAND TOTAL -	1	3	19	110	133

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Administrative Information

Investigator-In-Charge (IIC)

JEFFREY L. KENNEDY

Additional Persons Participating in This Accident/Incident Investigation:

TR PROVEN
Federal Aviation Administration
Washington, DC 20594

Michael Ginn
U.S. Customs
Miami, FL 33159

John Darbo
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Forth Worth, TX 75261

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