Turbulence injuries, National Airlines, Inc., Boeing 747-135, N77772, Near Lake Charles, Louisiana, January 4, 1972

Micro-summary: **This Boeing 747-135 experienced turbulence in-flight, injuring several occupants.**

Event Date: **1972-01-04 at 1314 CST**

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

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

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AIRCRAFT ACCIDENT REPORT

National Airlines, Inc.,
Boeing 747-135, N77772,
Near Lake Charles, Louisiana
January 4, 1972

Adopted: July 12, 1972

NATIONAL TRANSPORTATION SAFETY BOARD
Washington, D. C. 20591
REPORT NUMBER: NTSB-AAR-72-21

TABLE OF CONTENTS

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D. C. 20591
AIRCRAFT ACCIDENT REPORT

Adopted: July 12, 1972

NATIONAL AIRLINES, INC.,
BOEING 747-135, N77772,
NEAR LAKE CHARLES, LOUISIANA
JANUARY 4, 1972

SYNOPSIS

National Airlines, Inc., Flight 41, a Boeing 747-135, N77772, was a scheduled passenger nonstop flight, operating from Miami International Airport, Miami, Florida, to Los Angeles International Airport, Los Angeles, California. At departure from Miami on January 4, 1972, there were 317 passengers and a crew of 13 aboard Flight 41.

Departure, climb, and initial cruise at assigned Flight Level 310 (FL 310) were routine.

At 1314 c.s.t., approximately 50 miles southeast of Lake Charles, Louisiana, one jolt of turbulence was encountered. Crewmembers on the flight deck and in the forward section of the aircraft cabin described the jolt as light to moderate in intensity. In the rear cabin, the jolt was much more severe. Thirty-eight passengers and four stewardesses sustained injuries which ranged from minor to serious.

After determining that weather conditions in the immediate area were not favorable for landing, and after receiving assurance from two physicians attending to the injured that there would be no danger if more extensive treatment was not administered immediately, the captain decided to continue the flight to Los Angeles.

After requesting and receiving preferential air traffic control handling, Flight 41 proceeded to Los Angeles International Airport and landed at 1425 P.s.t.

PROBABLE CAUSE

The National Transportation Safety Board determines that the probable cause of this accident was an encounter with sharp-gust convective turbulence during flight in instrument meteorological conditions while numerous occupants of the aircraft were unsecured by seatbelts even though the seatbelt sign was lighted. The Board also determines that a number of passengers were injured because priority was given by the stewardesses to regular passenger service duties rather than to the enforcement of seatbelt usage.

RECOMMENDATIONS

Subsequent to the investigation of a previous B-747 accident involving turbulence, the Board recommended to the Federal Aviation Administration improvements or corrective action concerning seatbelt discipline and air carrier policy on deviation of flight. Those recommendations apply equally in this case.

As a result of the current investigation, the Board has recommended that a reevaluation be made of the installation of Sundstrand flight data recorders on 747 aircraft, that the Sundstrand flight data recorder vertical-accelerometer system be modified, and that a reassessment be made of the number, type, and location of required first-aid kits and of the adequacy of the first-aid kit contents. Additionally, the Board recommends that the Federal Aviation Adminstration require that whenever the passenger seatbelt light is turned on, irrespective of whether or not the flight attendants are performing passenger service duties, they shall immediately visually check seatbelts and remind the passengers to keep belts snugly fastened.

INVESTIGATION

National Airlines, Inc., Flight 41 (NA 41), a Boeing 747-135, N77772, was a regularly scheduled passenger flight between Miami International Airport (MIA), Florida, and Los Angeles International Airport (LAX), California, on January 4, 1972. There were 317 passengers and a crew of 13 aboard the flight.

Departure, climb, and initial cruise at assigned Flight Level 310 (FL 310) were routine.

In the vicinity of Sarasota, Florida, the captain turned off the seatbelt sign and made a public-address system announcement to that effect. He also advised the passengers that they would be flying through a cold front along the Louisiana-Texas coastline, prior to which he would turn the seatbelt sign on, and that he would expect the passengers to return to their seats and fasten their seatbelts.

The flight entered instrument meteorological conditions in the form of a cirrus cloud layer located in advance of the cold front. No turbulence was encountered. The seatbelt sign was turned on and an announcement was made by the captain to the effect that the flight was entering the cold front area and all passengers should take their seats and fasten their seatbelts. At the same time, the captain informed the stewardesses to continue serving lunch until such time as he turned the "no smoking" sign on and made an announcement for them to take their seats and fasten their seatbelts.

Two individual stewardesses made three or four additional "Take your seat and fasten your seatbelt" announcements, inasmuch as some passengers had not complied with the captain's request.

At approximately 1314, 1/ approximately 50 miles southeast of Lake Charles, Louisiana, at FL 310, one jolt of turbulence was experienced which was later described by crewmembers who were on the flight deck and in the forward sections of the passenger cabin as light to moderate in intensity.

Shortly, thereafter, the supervisory stewardess called the flight deck to advise the captain that several persons were injured in the rear cabin.

The captain proceeded to the rear cabin to assess the situation and found that ". . . several persons had been injured, food had been spilled, etc."

1/ All times used herein are central standard time based on the 24-hour clock.

The captain returned to the flight deck and contacted the National Airlines Flight Control Dispatcher in Miami, advising him of the injuries and requesting the weather conditions for a possible landing at several airports in Texas. After determining that weather, field conditions, and ground handling capabilities were not favorable at the Texas airports and after consulting with the injured passengers and with the two physicians who were treating the injured to be assured that no one with severe injury was in immediate danger, the captain decided to continue the flight to Los Angeles.

At 1353:30, NA 41 advised Houston ARTCC of the injured passengers and cabin-crew personnel and of the flight's intention to continue to Los Angeles. At the same time, Inertial Navigation System routing direct to LAX was requested. Houston ARTCC was unable to approve this request because of restricted areas along the direct route. NA 41 was later cleared direct to LAX after passing the restricted areas and landed at 1625.

Ambulances and airport fire department personnel met the aircraft when it taxied to its assigned gate. Uninjured and less seriously injured passengers deplaned first, followed by the more seriously injured.

In all, 38 passengers, including one child under 2 years of age, and four stewardesses had suffered minor to serious injuries. Four passengers and one stewardess were hospitalized. The other injured persons received emergency room care and were released.

The high-level significant weather prognostic chart, which had a verifying time of 1200, showed a cloud layer in the area of the accident with bases at 27,000 feet and tops at 36,000 feet and a few cumulonimbus clouds with tops at 36,000 feet. The chart contained a note as follows:

> Unless otherwise indicated, thunderstorms and cumulonimbus imply moderate to greater turbulence and icing.

An aviation area forecast, issued by the National Weather Service Forecast Office at New Orleans, Louisiana, at 0640, valid from 0700 to 1900, contained a SIGMET 2/ as follows:

> Louisiana, Mississippi, Alabama, Florida west of 85 degrees, coastal water; scattered to numerous embedded thunderstorms in lines, with a few severe thunderstorms likely, tops 45,000, 0700-1300.

The pilot had received a briefing on this SIGMET, along with other weather information pertinent to NA 41's route of flight, prior to departure from MIA.

2/ An advisory concerning weather of such severity as to be potentially hazardous to all categories of aircraft.

Because of this accident and other turbulence encounters experienced by Boeing 747 (B-747) aircraft which also resulted in passenger injury and because of the recency of design and operation of the new, wide-bodied jet, the Board requested that The Boeing Co. initiate a special simulation study to determine if the B-747 exhibits any special sensitivity to turbulence. The results of the study were compared with Boeing data obtained during the B-747 flight-test gust load survey program. This latter data tended to substantiate the results of the simulation study. The B-747 study results, along with similar data relating to the B-707 aircraft, were submitted to the Board. The findings were as follows:

1. When encountering a vertical gust, the aircraft tends to pitch about the center of gravity (c.g.). This pitching moment is coupled with the vertical translation, resulting in a variation of the peak-load factor applied along the fuselage. In the case of a downdraft, where a negative load factor is applied at the aircraft c.g., the accompanying pitching acceleration causes a reduction of the load forward of the c.g., whereas the load factor aft of the c.g. is amplified. This characteristic is typical for all aircraft. For the B-747, considering the fuselage as a rigid body, incremental accelerations at the aft fuselage station can exceed those at the pilot station by a factor of 1.5.

2. The higher frequency aeroelastic effect of the fuselage structure does not contribute significantly to the injury-producing displacement caused by a turbulence encounter.

3. The B-747 autopilot, when operating in any mode, tends to decrease the pitching acceleration, thus decreasing the variation of peak-load factors along the fuselage.

4. The response of the B-747 is predictable and very similar to the response of the B-707 when subjected to the gust spectrum.

The Board's investigation further determined that the Sundstrand Data Control ARINC 542 Flight Data Recorder installed on NA 41 was not recording vertical acceleration properly. Tests, recommended by the Board and performed by The Boeing Company, indicated that the Sundstrand vertical-acceleration recording is attenuated above a vibratory environment of 1.0 cycles per second on 747 aircraft.

Two first-aid kits of the type required by Section 121.309 of the Federal Aviation Regulations were on board NA 41 and were utilized. Additionally, supplies contained in a supplemental National Airlines kit were used. Statements regarding the inadequacy of the first-aid supplies

were made by the two physicians and a nurse who attended to the injured passengers, by four passengers (two of whom were injured), and by a deadheading stewardess from another airline. Deficiencies included two items which are not presently required by regulation: adhesive tape and material for splints. Additionally, large gauze compresses and large triangular bandages, presently required by regulation, were not included in sufficient quantity.

ANALYSIS

Except for a 3-hour takeoff delay because of maintenance difficulties, the flight of NA 41 was routine until its encounter with turbulence southeast of Lake Charles, Louisiana.

Weather radar photographs taken at Lake Charles, Louisiana, within 1 minute of the estimated accident time, showed an extensive area of weather activity to the southeast of Lake Charles at a distance of 50 to 100 miles.

Accordingly, the Safety Board concludes that, even though the aircraft was clear of the heaviest precipitation areas depicted on the aircraft's radar at the time of the encounter, the aircraft was within the influence of the strong vertical wind currents commonly found in and around thunderstorm activity.

Subsequent to the accident, the flight data recorder unit was subjected to tests by The Boeing Company to verify its ability to respond to characteristic inputs. The vertical-acceleration channel was found to have excessive damping. The Board concludes that the recorder failed to respond to the pertinent inputs, and further, that the unit as installed did not comply with Sections 121.343 and 37.150 of the Federal Aviation Regulations.

The absence of a valid vertical-acceleration trace on the flight data recorder precluded a determination of the magnitude and time history of the forces acting on the aft portion of the fuselage in the area where the passengers and stewardesses were injured. A review of injuries and statements of unrestrained passengers and stewardesses disclosed that the aft section was subjected to an acceleration acting downward and to the left.

According to crewmember and passenger statements, the seatbelt sign had been turned on approximately 30 minutes prior to the turbulence encounter. However, as the flight had remained smooth prior to the jolt, the captain had no reason to instruct the stewardesses to suspend meal service and be seated. Consequently, four stewardesses located in the aft coach sections were preparing meal service when the jolt was encountered. This accident vividly illustrates the risk cabin attendants regularly must contend with when they are engaged in normal cabin duties and turbulence is encountered.

All injuries were sustained by passengers and crewmembers in the two aft coach sections of the aircraft. Most of the passengers who received injuries were in their seats with the seatbelts either unfastened or fastened loosely.

Instructions contained in the National Airlines Stewardess Manual regarding "Regulations" state:

> Whenever the seatbelt sign is turned on, the appropriate (Turbulence or Descending) announcement must be made. Seatbelts must be checked.

Accordingly, the Board concludes that preoccupation with an attempt to provide acceptable meal service and an extensive time period (30 minutes) of seatbelt sign illumination prevented the coach section stewardesses from maintaining effective seatbelt discipline in the two aft coach sections.

Because of the reported deficiencies regarding first-aid supplies onboard NA 41; in particular, regarding adhesive tape, large gauze compresses, large triangular bandages, and material for splints, the Board is concerned that emergency medical supplies required on large commerical aircraft are inadequate in both content and quantity. As the number of passengers increases, so should the required number of first-aid supplies to provide properly for in-flight situations which may arise. Likewise, the first-aid kit contents should be broadened to include those items required to care for injuries of a more serious nature.

PROBABLE CAUSE

The National Transportation Safety Board determines that the probable cause of this accident was an encounter with sharp-gust convective turbulence during flight in instrument meteorological conditions while numerous occupants of the aircraft were unsecured by seatbelts even though the seatbelt sign was lighted. The Board also determines that a number of passengers were injured because priority was given by the stewardesses to regular passenger service duties rather than to the enforcement of seatbelt usage.

RECOMMENDATIONS

Subsequent to the investigation of a previous B-747 accident involving turbulence, the National Transportation Safety Board recommended to the Federal Aviation Administration improvements or corrective action concerning seatbelt discipline and air carrier policy on deviation of flight.

As a result of this investigation, on April 19, 1972, the Board recommended that the Federal Aviation Administration: (1) reevaluate the installation of Sundstrand recorder on B-747 aircraft, and (2) issue an Airworthiness Directive requiring modification of the Sundstrand recorder vertical accelerometer system to conform to the Federal Aviation Regulations.

On June 14, 1972, the Board further recommended that the Federal Aviation Administration: (1) amend FAR 121.309 to provide a more appropriate basis for determining the number, type, and location of first-aid kits required on airplanes capable of carrying more than 25 persons; and (2) upgrade the required first-aid kit contents to ensure satisfactory capability for treatment of fractures and severe lacerations for extended periods of time.

Additionally, the Board recommends that the Federal Aviation Administration:

> Require that whenever the passenger seatbelt light is turned on, irrespective of whether or not the flight attendants are performing passenger service duties, they shall immediately visually check seatbelts and remind the passengers to keep belts snugly fastened.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD:

/s/ JOHN H. REED
Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ LOUIS M. THAYER
Member

/s/ ISABEL A. BURGESS
Member

/s/ WILLIAM R. HALEY
Member

July 12, 1972.

CREW INFORMATION

Captain Edward P. McDonald, aged 56, held airline transport rating certificate No. 81311-41. At the time of the accident, he had accumulated a total of 24,454 flying hours, of which 853 were in the 747. He had been on duty 6 hours and 30 minutes, 2 hours and 30 minutes of which was flying time. He held a first-class medical certificate dated July 12, 1971, with the following limitation: "Holder shall possess correcting glasses for near vision while exercising privileges of his airman's certificate. Captain McDonald had completed his last proficiency check on September 29, 1971, and his last line check on November 23, 1971.

First Officer William C. Naftel, aged 32, held commercial and instrument certificate No. 1393866. At the time of the accident, he had accumulated a total of 5,986 flying hours, of which 892 were in the 747. He had been on duty 6 hours and 30 minutes, 2 hours and 30 minutes of which was flying time. He held a first-class medical certificate dated November 23, 1971, with no limitations. He had completed his last proficiency check on October 8, 1971, and his last line check on October 21, 1971.

Flight Engineer James R. Johnson, aged 51, held commercial and instrument certificate No. 1303119, flight engineer certificate No. 1134552, and airframe and powerplant certificate No. 96169. At the time of the accident, he had accumulated a total of 20,539 flying hours, of which 881 were in the 747. He had been on duty 6 hours and 30 minutes, 2 hours and 30 minutes of which was flying time. He held a second-class medical certificate with no restrictions. He had completed his last proficiency check on September 25, 1971, and his last line check on June 17, 1971.

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