

AA2020-4

**AIRCRAFT ACCIDENT
INVESTIGATION REPORT**

**T'WAY AIR
HL 8021**

July 30, 2020

The objective of the investigation conducted by the Japan Transport Safety Board in accordance with the Act for Establishment of the Japan Transport Safety Board and with Annex 13 to the Convention on International Civil Aviation is to determine the causes of an accident and damage incidental to such an accident, thereby preventing future accidents and reducing damage. It is not the purpose of the investigation to apportion blame or liability.

TAKEDA Nobuo
Chairman
Japan Transport Safety Board

Note:

This report is a translation of the Japanese original investigation report. The text in Japanese shall prevail in the interpretation of the report.

AIRCRAFT ACCIDENT INVESTIGATION REPORT

FLIGHT ATTENDANT INJURY BY THE SHAKING OF THE AIRCRAFT T'WAY AIR BOEING 737-800, HL8021 OVER HITACHIOTA CITY, IBARAKI PREFECTURE, JAPAN AT AROUND 09:57 JST, MAY 2, 2019

July 3, 2020

Adopted by the Japan Transport Safety Board

Chairman	TAKEDA Nobuo
Member	MIYASHITA Toru
Member	KAKISHIMA Yoshiko
Member	MARUI Yuichi
Member	MIYAZAWA Yoshikazu
Member	NAKANISHI Miwa

1. PROCESS AND PROGRESS OF THE AIRCRAFT ACCIDENT INVESTIGATION

1.1 Summary of the Accident	<p>On May 2, 2019, at 08:26 a Boeing 737-800, registered HL8021, operated by T'way Air as a scheduled flight 201 took off from Incheon International Airport with a total of 186 persons on board, consisting of the Pilot in Command (PIC), five other crew members and 180 passengers. The aircraft encountered shaking during the descent to Narita International Airport, which caused a flight attendant to fall down resulting in her injury.</p>
1.2 Outline of the Accident Investigation	<p>On May 3, 2019, upon receipt of the occurrence of this accident, The Japan Transport Safety Board designated an investigator-in-charge and an investigator to investigate this accident.</p> <p>The occurrence of the accident was notified to the United States of America, as the State of Design and Manufacture of the aircraft involved in the accident, and the State did not designate its accredited representative.</p> <p>An accredited representative and an adviser of the Republic of Korea, as the State of Registry and Operator of the aircraft involved in this accident, participated in the investigation.</p> <p>Comments were invited from parties relevant to the cause of the accident and the Relevant State.</p>

2. FACTUAL INFORMATION

2.1 History of the Flight	<p>According to the statements of the PIC, the first officer (FO) and the injured flight attendant and the record of flight data recorder (hereinafter referred to as "FDR"), the history of the flight is summarized as follows.</p>
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On May 2, 2019, at 08:26 KST/JST (KST/JST: UTC+9 hours; unless otherwise noted, all times are indicated in KST/JST in this report on a 24-hour clock) a Boeing 737-800, registered HL8021, operated by T'way Air as scheduled flight 201, took off from Incheon International Airport for Narita International Airport. In the cockpit, the PIC sat in the left pilot's seat as PF*1 and the FO in the right pilot's seat as PM*1. Prior to the departure from Incheon

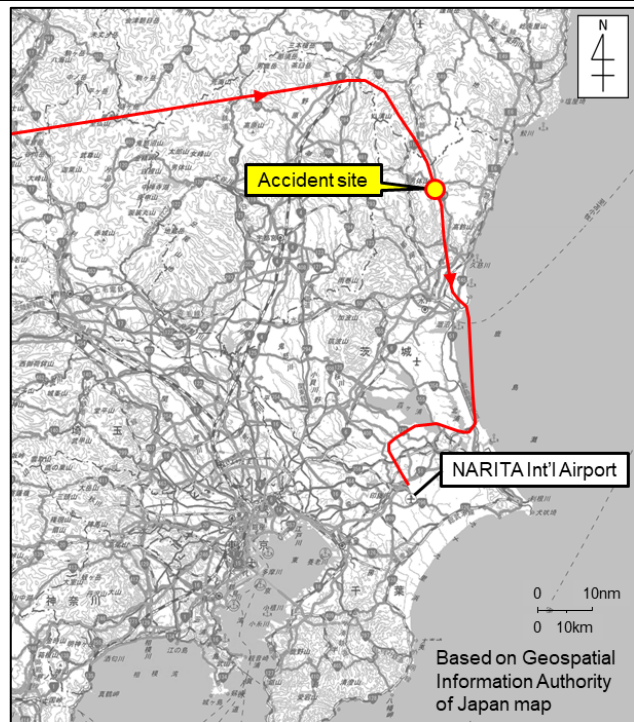


Figure 1: Estimated flight routes of the Aircraft

International Airport, the PIC and the FO confirmed that the weather conditions were not such that might affect the flight of the Aircraft although a temporary light thunderstorm was forecasted in the around Narita International Airport from 12 o'clock through 15 o'clock, and informed flight attendants that there was nothing in particular to note in relation to the weather.

While the Aircraft was descending to Narita International Airport at FL*2 200, the PIC rang the chimes three times in accordance with FOM*3 and let four flight attendants begin preparing for the landing. Then, because the PIC visually recognized a belt of thin cloud ahead at around FL180, he, considering safety of the passengers, rang the chimes once and illuminated seat belt sign to inform flight attendants that light turbulence was predicted. Then, the Aircraft passed through the thin cloud. While passing through the thin cloud, the PIC and the FO felt not only a slight shaking but also the shaking that was much bigger than the average level they had expected.

At that time, flight attendants were ensuring safety in the cabin by confirming that the passengers fastened their seat belts. Because two flight attendants in the forward area of the cabin were taking care of with passengers who were in lavatory, a flight attendant covering the right aft area (hereinafter

*1 "PF" and "PM" are the terms used to identify pilots by their different roles in aircraft operated by two persons. PF is an abbreviation of Pilot Flying and is mainly responsible for maneuvering the aircraft. PM is an abbreviation of Pilot Monitoring mainly responsible for monitoring flight status of the aircraft and cross-checking of PF's maneuvering and undertakes other non-operational tasks.

*2 "FL" denotes a pressure altitude in the standard atmosphere. FL is expressed in the value obtained by dividing the reading on the altimeter (in feet) by 100 when the altimeter is set to 29.92 inHg. Flight altitude over 14,000 ft is generally expressed in FL in Japan. For instance, FL200 stands for an altitude of 20,000 ft.

*3 "FOM" is an abbreviation of Flight Operations Manual that defines fundamental policy, implementation method, procedures, criteria and so on that should be followed by employees engaged in flight operations when the company conducts aviation transport operations. FOM is treated with the highest priority given in its operation.

referred to as “Flight Attendant A”) was ensuring safety from aft galley to around the 10th row in the forward zone. When Flight Attendant A was near the 23rd row in the midst of returning to her seat, the Aircraft suddenly shook severely. After Flight Attendant A felt like floating by the shaking, she lost her balance and severely fell down backward. Flight Attendant A attempted to regain her feet promptly thereafter, however, she was unable to put some muscle due to a strong pain in her right ankle and took an empty seat (25D) in the aft (see Figure 2). There was no indication of echo on airborne weather radar or no turbulence information by PIREP. The descent was being performed by autopilot.

Because Flight Attendant A the pain in the right ankle that was so severe with a significant swelling as to be unable to move, she judged that she was unable to continue her duties and decided to keep seated until the landing.

The Aircraft landed at Narita International Airport at around 10:15.

After the landing, Flight Attendant A was diagnosed at the hospital as right tibia and distal end of fibula fractured.

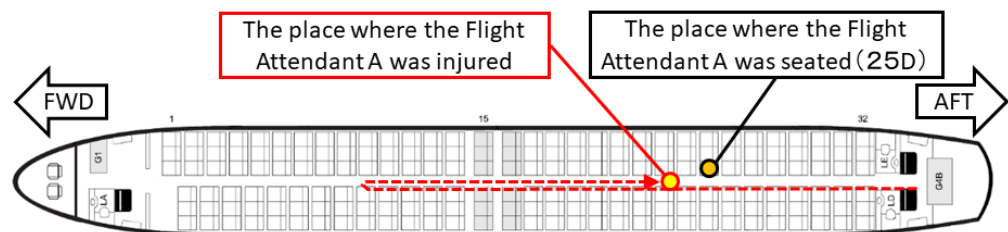


Figure 2: The flight attendant’s position when injured

According to FDR records of the Aircraft from 09:57:12 until 09:57:14, roll angle changed in the range from 15.3° to the left to 3.7° to the right , and at the same time, vertical acceleration speed instantaneously changed in the range from +0.685G to +2.308G. Lateral acceleration speed at this time changed by 0.048G in the left direction and 0.074G in the right direction. Simultaneously, changes in longitudinal acceleration speed and air speed were also recorded. (See Figure 3)

This accident occurred at around 09:57 on May 2, 2019, at FL160 over Hitachiota City, Ibaraki Prefecture (36° 43’ 15” N, 140° 29’ 24” E).

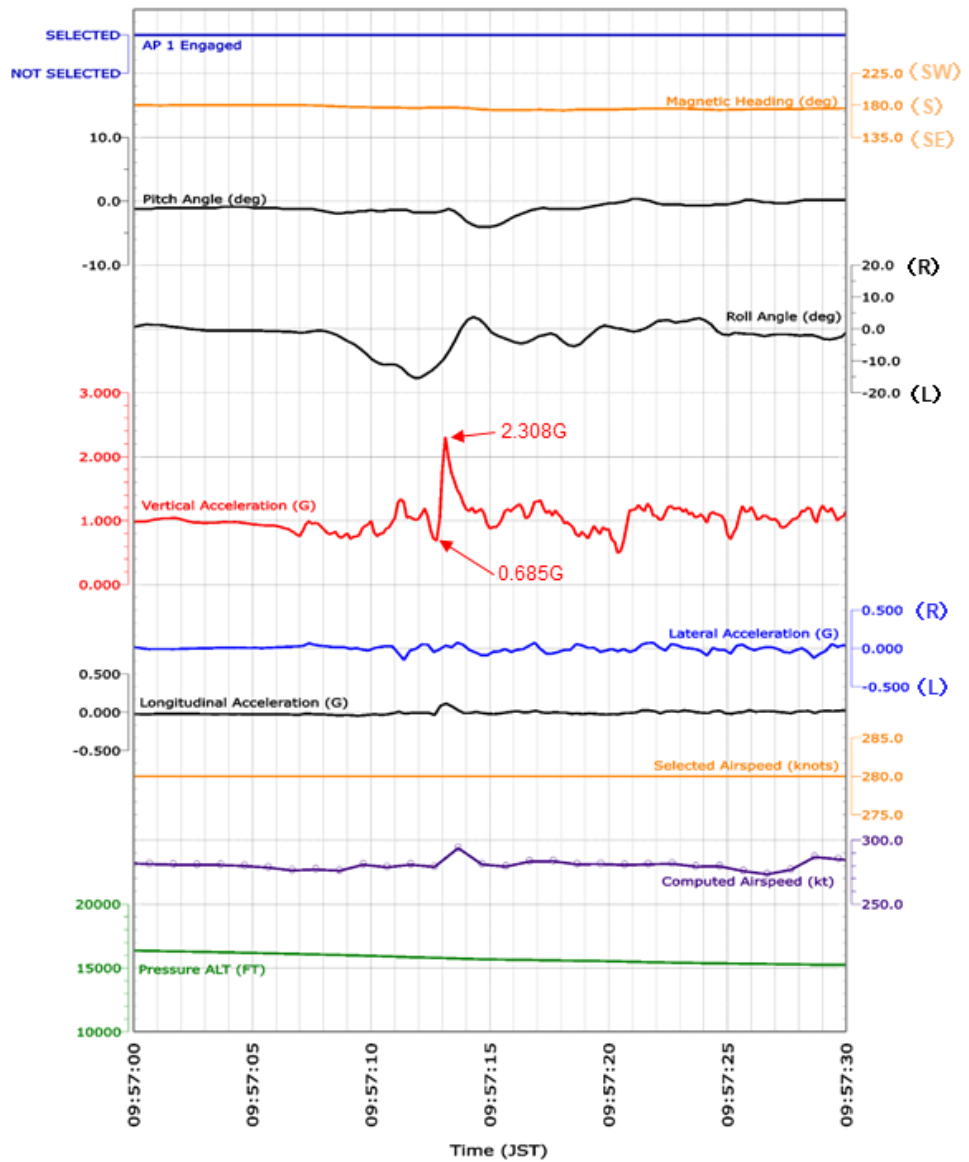


Figure 3: FDR records

2.2 Injuries to Persons	A flight attendant was seriously injured (right tibia and distal end of fibula were fractured)
2.3 Damage to Aircraft	None
2.4 Personnel Information	<p>(1) PIC Male/Age 47</p> <p>Airline transport pilot certificate (Airplane) July 10, 2007</p> <p>Type rating for Boeing 737 April 2, 2012</p> <p>Class 1 aviation medical certificate</p> <p>Validity September 30, 2019</p> <p>Total flight time 9,463 hours 36 minutes</p> <p>Total flight time on the type of aircraft 1,553 hours 56 minutes</p> <p>(2) FO Male/Age 32</p> <p>Commercial pilot certificate (Airplane) June 15, 2017</p> <p>Type rating for Boeing 737 August 23, 2018</p> <p>Instrument flight certificate (Airplane) June 19, 2017</p>

	<p>Class 1 aviation medical certificate</p> <p>Validity September 30, 2019</p> <p>Total flight time 846 hours 33 minutes</p> <p>Total flight time on the type of aircraft 514 hours 19 minutes</p>
2.5 Aircraft Information	<p>(1) Aircraft</p> <p>Type Boeing 737-800</p> <p>Serial number 34889</p> <p>Date of manufacture December 6, 2006</p> <p>Certificate of airworthiness IS14022</p> <p>At the time of the accident, the weight and balance of the aircraft are estimated to have been within the allowable ranges.</p>
2.6 Meteorological Information	<p>(1) Meteorological Data Confirmed by Flight Crew</p> <p>i) Meteorological data confirmed prior to the flight</p> <p>Flight crew judged that weather conditions were not such that might affect the flight because METAR (Aviation routine weather report) or the significant weather prognostic chart issued by London WAFC*⁴ did not observe or predict severe weather in the flight route of the accident Aircraft although TAF (Aerodrome Forecast) for Narita International Airport they confirmed prior to the departure forecasted a light thunderstorm from 12 o'clock through 15 o'clock after arrive.</p> <p>ii) Turbulence information</p> <p>OCC (Operation Control Center) of the Company always keeps monitoring meteorological data provided by the Korea Meteorological Administration or meteorological forecast providers. Should a severe turbulence that may affect flight be predicted, such information is provided with flight crew by ACARS*⁵. There was no turbulence information that should be reported to the accident Aircraft, and accordingly, no information was provided with the flight crew.</p> <p>Besides, there was no turbulence information provided in flight by ATC.</p> <p>(2) Meteorological Data at the Time of the Occurrence of the Accident</p> <p>i) Domestic significant weather observation chart (Figure 4)</p> <p>According to domestic significant weather routine chart for 10 o'clock issued by the Japan Meteorological Agency at 10:10 on the accident day, on the radar, from 5 mm or more to less than 10 mm precipitation per hour was observed along the flight route of the Aircraft. Besides, lightning was observed in the cloud near the accident site.</p> <p>ii) Hourly atmosphere analysis chart (Figure 5)</p> <p>Hourly atmosphere analysis chart as of 10 o'clock on the accident day indicated Vertical Wind Shears (VWS) of 6 to 9 kt/1,000 ft near the accident site.</p> <p>iii) PIREP</p>

*⁴ "WAFC" is an abbreviation of World Area Forecast Centre and denotes a meteorological centre that prepares meteorological information to provide aeronautical meteorological forecast with aviation traffic control agency around the world. WAFC is situated in London and Washington D.C.

*⁵ "ACARS" is an abbreviation of Aircraft Communications Addressing and Reporting System and denotes system that provides information necessary for flight of aircraft through digital data transmission from the ground to aircraft or vice versa.

PIREP (Pilot Report) issued by the Japan Meteorological Agency reported turbulence within an hour before and after the accident over the vicinity of Tokyo International Airport; however, there was no such a report over the vicinity of the accident site. (Figure 4)

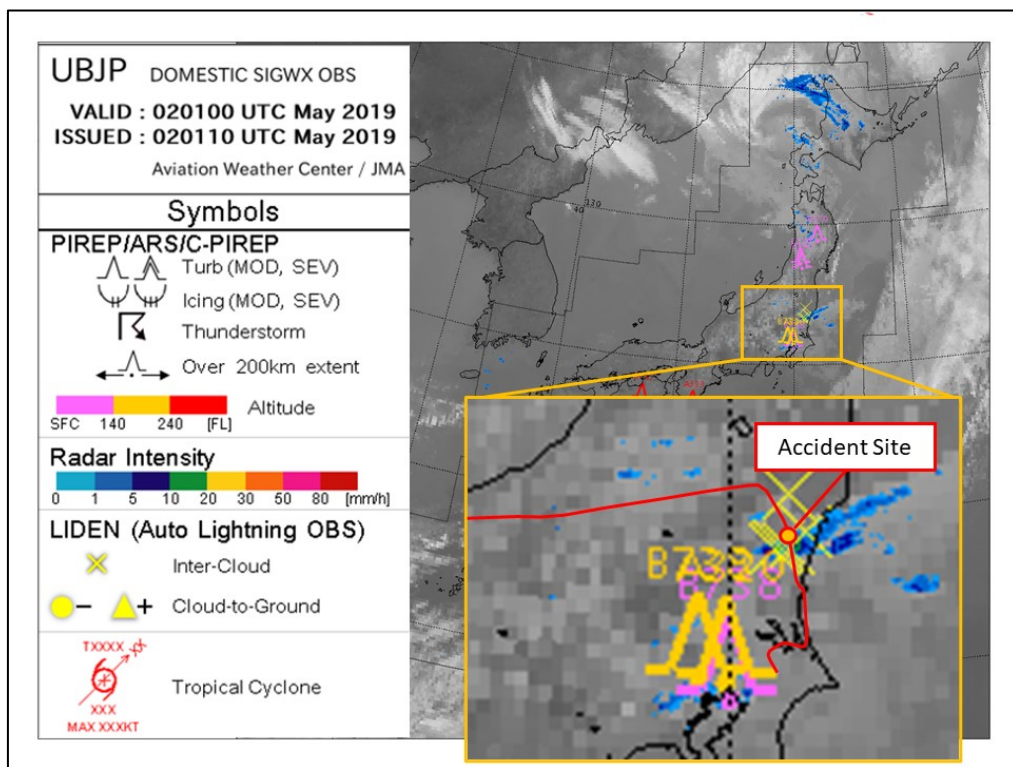


Figure 4: Domestic significant weather observation chart

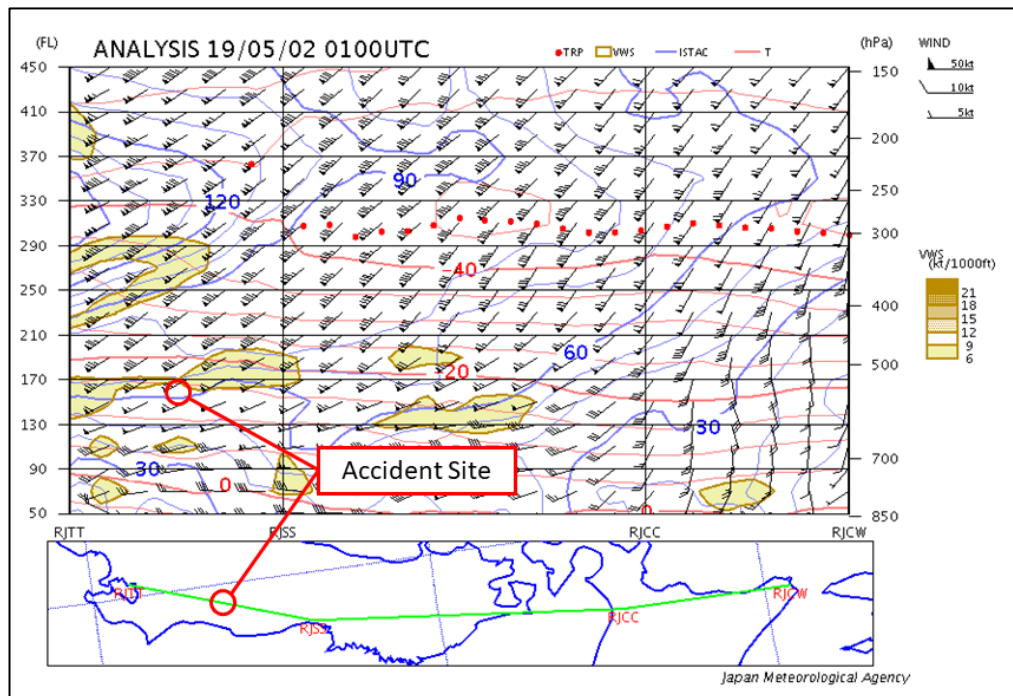


Figure 5: Hourly atmosphere analysis chart (cross section of flight route)

3. ANALYSIS

3.1 Involvement of Weather	Yes
3.2 Involvement of Pilot	None
3.3 Involvement of Aircraft	None
3.4 Analysis of Findings	<p>(1) Shaking of the Aircraft</p> <p>The shaking of the Aircraft at the time of the accident was to correspond to instantaneous changes in vertical acceleration speed and lateral acceleration speed during the period from 09:57:12 until 09:57:14 recorded in FDR, and it is highly probable that the Aircraft was descending in the thin cloud at this time. It is highly probable that the shaking caused Flight Attendant A who was ensuring safety in the cabin to lose her balance after feeling like floating and fall down severely backward, which resulted in her injury by an excessive force applied to the right ankle at that time.</p> <p>(2) Meteorology</p> <p>From domestic significant weather observation chart issued by the Japan Meteorological Agency, on the radar echo, from 5 mm or more to less than 10 mm precipitation per hour was observed near the accident site, and an hourly atmosphere analysis chart indicated Vertical Wind Shears near the accident site. It is probable that there might have occurred atmospheric disturbance near the accident site although there was no report of the PIREP regarding turbulence near the accident site within an hour before and after the accident.</p> <p>(3) PIC's Judgement on Meteorology</p> <p>It is probable that, even if the PIC predicted a chance to encounter a light turbulence, he did not expect to encounter a severe turbulence when passing the thin cloud, because meteorological data confirmed prior to the departure, the display of on-board weather radar and PIREP did not indicate turbulence along the flight route that might affect the flight.</p> <p>When visually recognized the thin cloud, the PIC, considering safety of the passengers, notified the flight attendants by the seat belt fastening chimes that a light turbulence was predicted; however, it is probable that the atmospheric disturbance bigger than the flight crew had expected generated along the flight route.</p>

4. PROBABLE CAUSES

In this accident, it is highly probable that the Aircraft was shaken by severe atmospheric disturbance it encountered during the descent, which caused Flight Attendant A who was ensuring safety in the cabin to lose her balance after feeling like floating and fall down severely backward, which resulted in her injury in the right ankle.

5. SAFETY ACTIONS

The Company took following safety actions to prevent recurrence of similar cases.

(1) Revision of the FOM

The company revised the FOM to describe more concrete measures when the aircraft encounters turbulence and decided to include a clause that the measures when encountering severe turbulence should be also taken for moderate turbulence.

(2) Issuance of Document to call for attention

The documents were issued and the accident cases upon encountering turbulence were shown to flight crew and flight attendants to call their attention to prioritizing their safety in such cases.

(3) Prevention of Flight Attendant's Injury

Documents were issued to flight attendants urging that they take a nearby empty seat or grasp armrest as measures to take when encountering turbulence. Besides, it was made well-known to flight attendants that they exercise like stretching at the briefing or during cruise flight to prevent injury beforehand, and video demonstrating the way of having a stretch was developed.