

AA2023-7

**AIRCRAFT ACCIDENT
INVESTIGATION REPORT**

**ANA Wings Co., Ltd.
J A 8 5 4 A**

October 26, 2023



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
Chairperson
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.

《Reference》

The terms used to describe the results of the analysis in "3. ANALYSIS" of this report are as follows.

- i) In case of being able to determine, the term "certain" or "certainly" is used.
- ii) In case of being unable to determine but being almost certain, the term "highly probable" or "most likely" is used.
- iii) In case of higher possibility, the term "probable" or "more likely" is used.
- iv) In a case that there is a possibility, the term "likely" or "possible" is used.

AIRCRAFT ACCIDENT INVESTIGATION REPORT

CABIN CREW MEMBER INJURY BY SHAKING OF THE AIRCRAFT ANA WINGS CO., LTD. BOMBARDIER DHC-8-402, JA854A AT FL 170 OVER YOSHINOAWA CITY, TOKUSHIMA PREFECTURE, JAPAN AT ABOUT 13:29 JST, JUNE 25, 2022

October 6, 2023

Adopted by the Japan Transport Safety Board

Chairperson TAKEDA Nobuo
Member SHIMAMURA Atsushi
Member MARUI Yuichi
Member SODA Hisako
Member NAKANISHI Miwa
Member TSUDA Hiroka

1. PROCESS AND PROGRESS OF THE AIRCRAFT ACCIDENT INVESTIGATION

1.1 Summary of the Accident	On June 25 (Saturday), 2022, while a Bombardier DHC-8-402, JA854A, operated by ANA Wings Co., Ltd., as a scheduled flight 1626 of All Nippon Airways Co., Ltd., as the joint undertaking for transport with ANA Wings, was flying from Kumamoto Airport to Osaka International Airport, the Aircraft was shaken, causing a cabin crew member to sustain an injury.
1.2 Outline of the Accident Investigation	Upon receipt of the notification of the accident occurrence, the Japan Transport Safety Board (JTSB) designated an investigator-in-charge and two other investigators on June 25, 2022 to investigate this accident. An accredited representative of Canada as the State of Design and Manufacture of the aircraft involved in this accident, participated in the investigation. Comments were invited from parties relevant to the cause of the accident and the Relevant State.

2. FACTUAL INFORMATION

2.1 History of the Flight	According to the statements of the pilot in command (PIC), the first officer (FO), and All cabin crew members (two) as well as the records of the Flight Data Recorder (FDR) and Cockpit Voice Recorder, the history of the flight is summarized as below. At 12:51 Japan Standard Time (JST: UTC + 9hrs, unless otherwise stated all times are indicated in JST on a 24-hour clock) on June 25, 2022, a Bombardier DHC-8-402, JA854A, operated by ANA Wings Co., Ltd., as a scheduled flight 1626 of All Nippon Airways Co., Ltd., as the joint undertaking for transport with ANA Wings, with 74 people on board, consisting of the PIC, three other crewmembers, and 70 passengers, took off from Kumamoto Airport
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for Osaka International Airport. In the cockpit of the Aircraft, the PIC sat in the left seat as PF*1 and the FO*1 qualified as PIC in the right seat as PM*1. In addition, the Crew in Charge (CIC) was seated in the No. 1 Cabin Attendant Seat, and the cabin crew member, who was mainly in charge of the aft cabin area, (L2) was seated in the No.2 Cabin Attendant Seat, respectively.



Figure 1: Accident aircraft

The seats on the Aircraft were almost fully occupied.

After its take-off from Kumamoto Airport, there were rain clouds from Kumamoto Prefecture to Oita Prefecture and the air currents were rather unfavorable, therefore the Aircraft climbed with the fasten seat belt sign (Belt Sign) turned on.

At 13:04:28, when the pressure altitude reached 23,000 ft (Flight Level (FL)*2) 230), though the Aircraft was flying in layered clouds, the PIC turned off the Belt Sign as having judged that there would be no significant turbulence. The CIC asked the PIC about the upcoming conditions of the turbulence as there was some light*3 level of turbulence even after the Belt Sign was turned off. The PIC told that the same level of turbulence would continue for five minutes, then calm down for five minutes, and another turbulence would continue for five minutes, then calm down again. In preparation for the turbulence, all cabin crew members decided to discontinue the planned in-flight services using service carts and provide only plastic bottles of water to passengers. The in-flight service finished in two to three minutes. All cabin crew members took each attendant seat in preparation for the turbulence after finishing the in-flight service (see Figure 2).

The Aircraft was flying in clouds and the flight crew members were confirming the cloud conditions by onboard weather radar. The onboard weather radar was set to auto-mode for the gain (receiver sensitivity) and manual for tilt (antenna vertical angle) and range (displayed distance).

At 13:19:25, just before Matsuyama VOR/DME, the Aircraft was instructed from Kobe Area Control Center to descend to reach FL 170 by

*1 "PF and PM" is a term for identifying a pilot from role sharing in an Aircraft controlled by two people. The PF (Pilot Flying) is mainly responsible for maneuvering the aircraft. The PM (Pilot Monitoring) mainly performs monitoring of flight condition of the aircraft, and makes cross check of operation of PF and operations other than maneuvering.

*2 "FL" is the altitude expressed as a numerical value obtained by dividing the altimeter instruction (unit: ft) when the altimeter setting value is set to 29.92 inHg at the pressure altitude of the standard atmosphere by 100. Flight levels are usually used in flight altitudes above 14,000 ft in Japan. As an example, FL 230 represents altitude 23,000 ft.

*3 "Light" refers to the "light" level of turbulence, which is classified into "light", "moderate", "severe" and "extreme".

ZOROH (see Figure 3) at FL 170, and started its descent approx. one minute later.

Just before reaching FL 170, echoes*⁴ were shown in front, therefore, the PIC turned on the Belt Sign at 13:24:40. The Aircraft's control was transferred to the Kansai Departure Controller (hereinafter referred to as "Kansai Departure") just after reaching to FL 170.

At 13:25:00, the Aircraft established communication with Kansai Departure, and was instructed to fly directly to KAINA (see Figure 3).

Although the Aircraft was flying in layered clouds, it passed through the echo area where turbulence might be generated, therefore the PIC turned off the Belt Sign at 13:27:40. The PIC also thought there might be some passengers who would want to go to the lavatory because the time period during which the Belt Sign had been turned off by then was short. After the Belt Sign was turned off, the CIC walked from front to back, and the L2 walked from back to front in the cabin to make a round check for the cabin. At this time, as being asked for water by a passenger, the L2 headed to the aft part of the Aircraft where the galley was located.

While the Aircraft was flying toward KAINA with the Aircraft heading 088°, flight crew members found several small echoes shown on the left side of its flight path on the onboard weather radar screen.

At 13:28:25, in order to avoid the echoes by changing its heading to the right, the PIC requested Kansai Departure for heading changes to 100°, obtained the clearance, and started to change the Aircraft heading at 13:28:31. However, as there was the cross wind from the right side, the PIC judged that this heading 100° would not allow to avoid the echoes, thus the PIC was going to request for the Aircraft heading 110°. However, then, FO made an assertion saying "How about increasing the heading angle by 10° more?", therefore the PIC requested Kansai Departure for the Aircraft heading 120° at 13:28:46. With the clearance, the PIC started to change the Aircraft heading. During its heading change, the Aircraft was flying about 5 nm (based on the statement of the PIC: the FO stated it was about 3 to 4 nm) away from the echoes, but it encountered a strong vertical tremor all of sudden by the time when the heading change ended.

The speed of the Aircraft that had been around 260 kt increased to 273 kt at 13:29:10. The auto-pilot of the Aircraft was disengaged and its altitude increased up to FL 174. The PIC made the power idle so as not to exceed the maximum operating limit speed (V_{MO}), and judging that returning to the altitude would exceed V_{MO} , the PIC took manual control to maintain the pitch.

On the other hand, in the cabin, when the strong vertical tremor was encountered, the L2 had just placed them on the top shelf with the same squat posture after opening the door of the aft galley, squatting down, and taking out the plastic bottles of water from the bottom shelf. Due to that tremor, the L2's

*⁴ "Echoes" refer to the reflective waves captured on the radar as radio waves emitted from a metrological radar are reflected by raindrop and ice particle, etc. The reflective waves allow to observe the distribution of precipitation area and the intensity, and this precipitation area may be also called "Echoes".

feet were completely away from the floor, and straightly the L2 fell down sideways on the floor from the low back. The CIC, who was moving backward around the center of the cabin, squatted down soon after the strong turbulence was encountered, and reflexively held the armrests of the passenger seats on both sides of the CIC with CIC's sides.

At 13:29:12, the FO promptly turned on the Belt Sign. The Aircraft continued shaking.

As the Belt Sign was turned on, the CIC was going to return to the CIC's seat while verbally communicating with the passengers in saying "Fasten your seat belts, please." After falling down, when the L2 came to, the L2 was lying in the aft galley, and unable to get up immediately and tried to grasp the bulkhead separating the cabin from the galley with his hand while lying down. Then the L2 managed to get up using the bulkhead as support, and was enduring the ongoing shaking while grabbing the armrest of the Seat 19C from below. While the shaking continued, the CIC crawled, stood up, grabbed the overhead compartment as support to return CIC's cabin attendant seat and took the seat. The L2 crawled up, drew out L2's cabin attendant seat, and took the seat.

At 13:29:34, the FO reported to Kansai Departure that the Aircraft encountered a moderate*5 turbulence. As the speed was reduced to 230 kt, the PIC returned the power to normal, engaged the auto-pilot at 13:29:45, and the Aircraft returned to the Aircraft heading 120° and FL 170.

The CIC made an announcement to provide the passengers with the information that a strong turbulence was encountered and encourage them to confirm that their seat belts were securely fastened.

When a flight crew member asked the CIC about the cabin condition, the CIC informed that the L2 appeared to be injured.

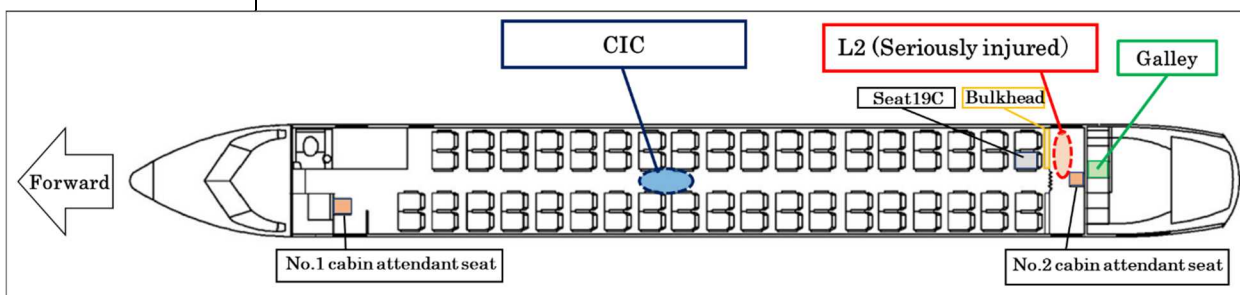


Figure 2: Locations of All the Cabin Crew Members at the Time of Aircraft Shaking

At 13:31:20, the flight crew member reported to Kansai Departure that the Aircraft passed through a bad weather area. As being instructed by Kansai Departure to fly directly to KAINA, the Aircraft followed the instruction.

CIC made an announcement requesting passengers to report if they felt physically sick or were injured due to shaking.

When the PIC asked the L2 about the condition of L2's injury over the interphone, the L2 answered that the whole L2's low back was painful. The

*5 "Moderate" represents the "moderate" level of turbulence classified as "light" "moderate" "severe" and "extreme".

CIC informed to the PIC over the interphone that as it was not sure if the L2 was able to walk or not, in the event of emergency, the CIC would take it into consideration to respond.

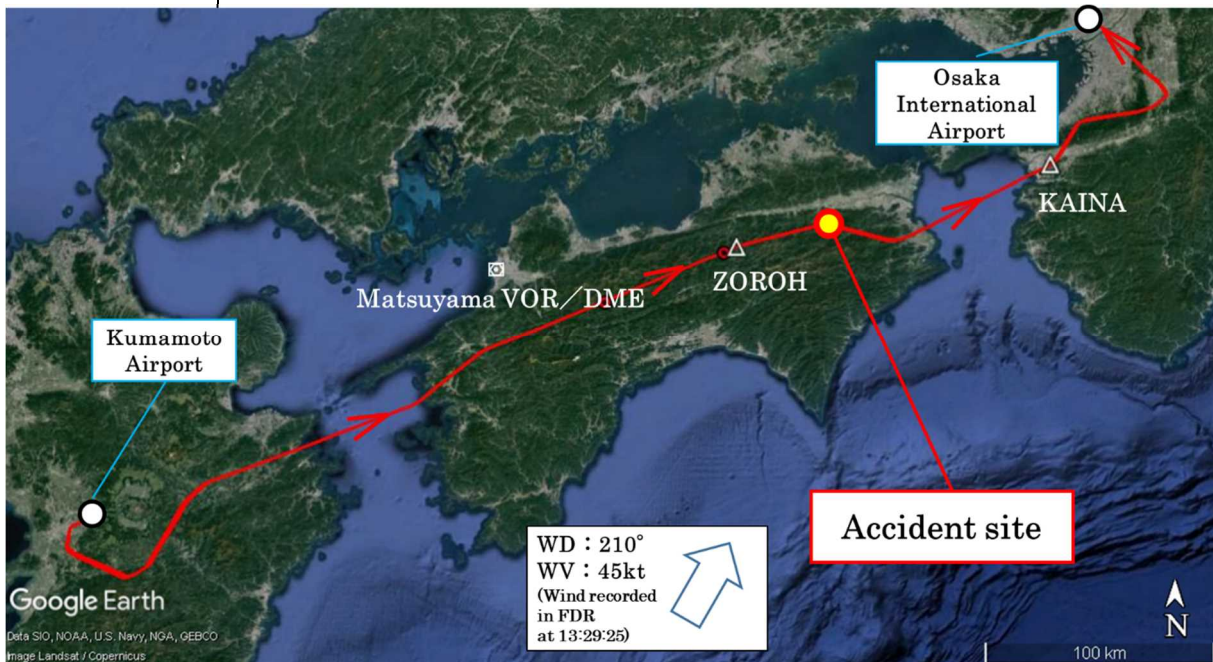


Figure 3: Estimated Flight Route

As the Aircraft passed through stratus clouds and it became possible to visually avoid the clouds, the PIC turned off the Belt Sign at 13:32:49. The CIC made the announcement again requesting passengers to report if they felt physically sick or were injured due to shaking. The PIC apologized for the sudden strong shaking and made an announcement encouraging passengers to report about a feeling physically sick or injuries. The CIC was walking toward the aft side of the Aircraft while confirming the conditions of the passengers, and checked the status of the L2's injury. As the L2 said that L2's low back was painful, but L2's hand was getting swollen, too, the CIC took an instant coolant out of a medical kit and handed it to the L2. Over the interphone, the CIC informed to the PIC that there had been no report from passengers about injuries so far, but the L2 was not in a walkable situation.

When returning to the forward side of the Aircraft, the CIC checked the cabin for any damage, but found no particular abnormality.

After that, the Aircraft made an approach toward Osaka International Airport and landed there at 13:55.

While Aircraft was taxiing to the spot after landing, the CIC and the PIC made the announcement encouraging passengers to report about a feeling physically sick or injuries.

After the Aircraft arrived at the spot and the passengers disembarked, the L2 disembarked from the Aircraft using a wheel chair and lifter. The L2 was transported by ambulance to the hospital and was diagnosed with a sacral fracture.

	This accident occurred about 13:29, on June 25, 2022, at FL 170 over Yoshinogawa City, Tokushima Prefecture (33°59'25" N, 134°13'22" E).																																
2.2 Injuries to Persons	One cabin crew member was seriously injured (Sacral fracture).																																
2.3 Damage to the Aircraft	None																																
2.4 Personnel Information	<p>(1) PIC: Age 36</p> <table> <tr> <td>Airline transport pilot certificate (Airplane)</td> <td>May 10, 2021</td> </tr> <tr> <td>Type rating for Bombardier DHC-8</td> <td>May 1, 2015</td> </tr> <tr> <td>Class 1 aviation medical certificate</td> <td></td> </tr> <tr> <td>Validity</td> <td>August 17, 2022</td> </tr> <tr> <td>Total flight time</td> <td>4,510 hours 04 minutes</td> </tr> <tr> <td>Flight time in the last 30 days</td> <td>76 hours 18 minutes</td> </tr> <tr> <td>Total flight time on the type of the aircraft</td> <td>4,287 hours 59 minutes</td> </tr> <tr> <td>Flight time in the last 30 days</td> <td>76 hours 18 minutes</td> </tr> </table> <p>(2) FO: Age 44</p> <table> <tr> <td>Airline transport pilot certificate (Airplane)</td> <td>June 13, 2012</td> </tr> <tr> <td>Type rating for Bombardier DHC-8</td> <td>August 8, 2007</td> </tr> <tr> <td>Class 1 aviation medical certificate</td> <td></td> </tr> <tr> <td>Validity</td> <td>December 20, 2022</td> </tr> <tr> <td>Total flight time</td> <td>9,044 hours 39 minutes</td> </tr> <tr> <td>Flight time in the last 30 days</td> <td>65 hours 28 minutes</td> </tr> <tr> <td>Total flight time on the type of the aircraft</td> <td>8,730 hours 54 minutes</td> </tr> <tr> <td>Flight time in the last 30 days</td> <td>65 hours 28 minutes</td> </tr> </table>	Airline transport pilot certificate (Airplane)	May 10, 2021	Type rating for Bombardier DHC-8	May 1, 2015	Class 1 aviation medical certificate		Validity	August 17, 2022	Total flight time	4,510 hours 04 minutes	Flight time in the last 30 days	76 hours 18 minutes	Total flight time on the type of the aircraft	4,287 hours 59 minutes	Flight time in the last 30 days	76 hours 18 minutes	Airline transport pilot certificate (Airplane)	June 13, 2012	Type rating for Bombardier DHC-8	August 8, 2007	Class 1 aviation medical certificate		Validity	December 20, 2022	Total flight time	9,044 hours 39 minutes	Flight time in the last 30 days	65 hours 28 minutes	Total flight time on the type of the aircraft	8,730 hours 54 minutes	Flight time in the last 30 days	65 hours 28 minutes
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2.5 Aircraft Information	<table> <tr> <td>Aircraft type</td> <td>Bombardier DHC-8-402</td> </tr> <tr> <td>Serial number</td> <td>4151</td> </tr> <tr> <td>Date of manufacture</td> <td>February 20, 2007</td> </tr> <tr> <td>Certificate of airworthiness</td> <td>No.TO-23-543</td> </tr> <tr> <td>Validity</td> <td>Period since February 24, 2012, the Maintenance Manual (All Nippon Airways Co., Ltd.) has been effective.</td> </tr> </table> <p>When the accident occurred, the weight and position of the center of gravity of the aircraft are estimated to have been within the allowable ranges.</p>	Aircraft type	Bombardier DHC-8-402	Serial number	4151	Date of manufacture	February 20, 2007	Certificate of airworthiness	No.TO-23-543	Validity	Period since February 24, 2012, the Maintenance Manual (All Nippon Airways Co., Ltd.) has been effective.																						
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2.6 Meteorological Information	<p>(1) General Weather Information</p> <p>At about 13:30 on June 25, 2022, a stationary front was extending from east to west over the Sea of Japan, the precipitation area extended from Kyushu to Shikoku on the south side of the front, and lightning had been detected. The lightning advisories had been reported in Tokushima Prefecture.</p>																																

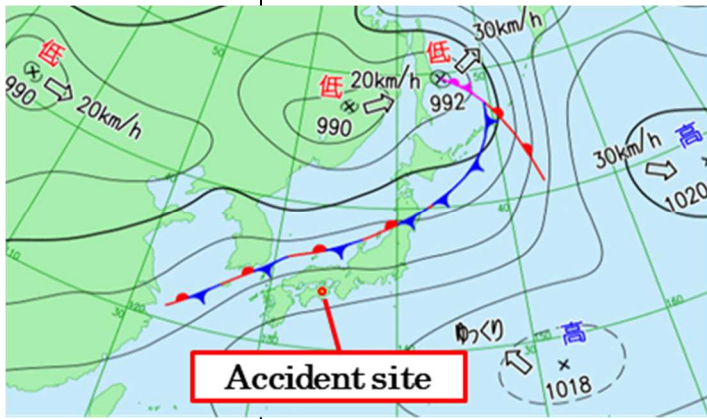


Figure 4: Weather Observation Chart around Japan (Excerpt) at 12:00 on June 25, 2022

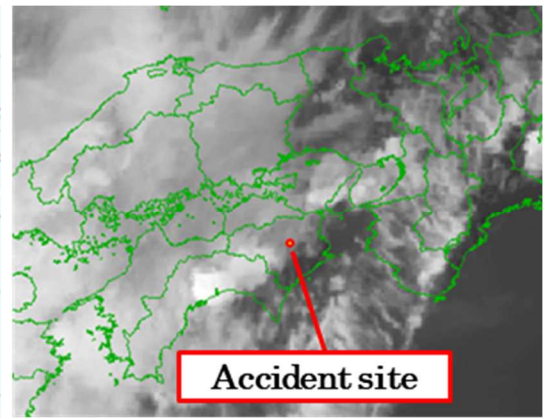


Figure 5: Weather Satellite Infrared Imagery (Excerpt) at 13:30 on June 25, 2022

(2) Domestic Significant Observation Chart

According to the Domestic Significant Observation Chart (Figure 6) at 14:00, announced by the Japan Meteorological Agency at 14:10 on June 25, 2022, rainfall echoes with a precipitation of 20 mm or more and less than 30 mm per hour and lightning were observed near the place where the accident occurred.

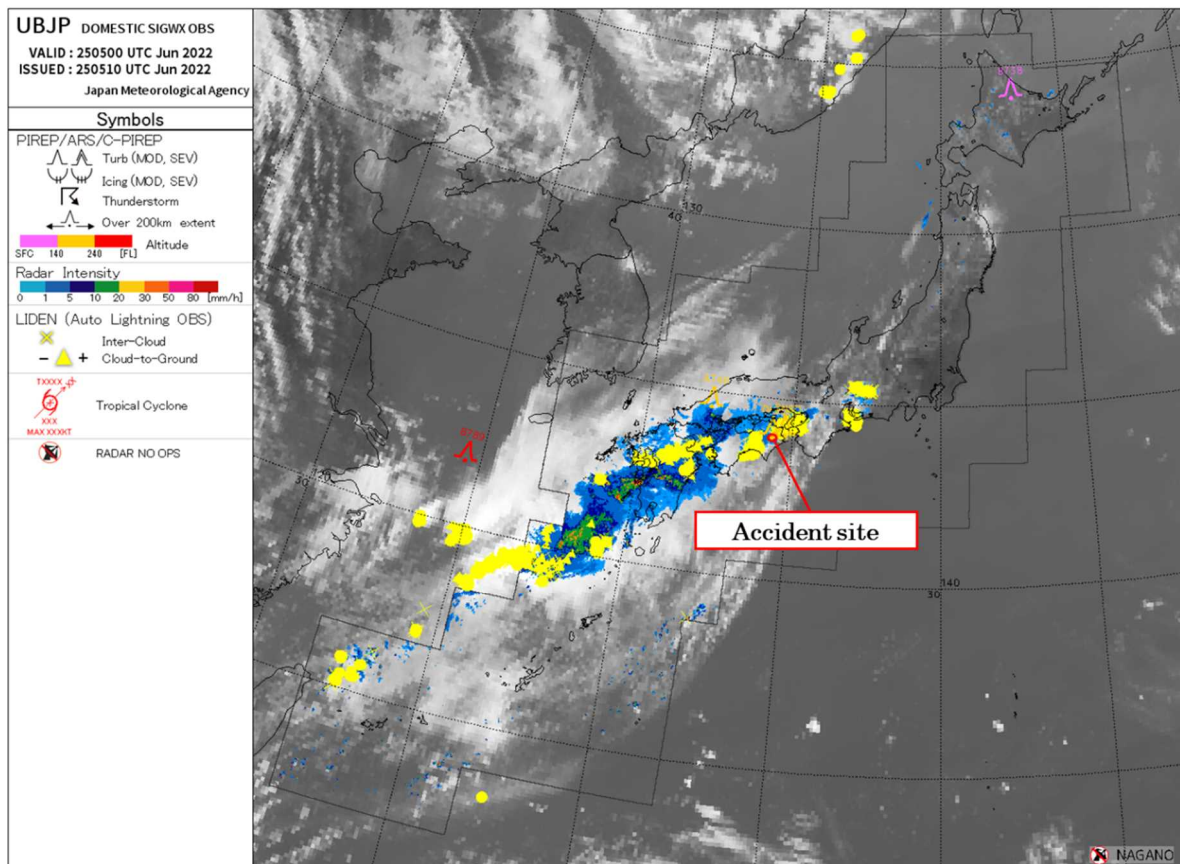


Figure 6: Domestic Significant Observation Chart at 14:00 on June 25, 2022

(3) Domestic Significant Weather Prognostic Chart

According to the Domestic Significant Weather Prognostic Chart (Figure 7) at 15:00, announced by the Japan Meteorological Agency at 03:15 on June 25, 2022, there was no forecast of significant weather near the place where the accident occurred.

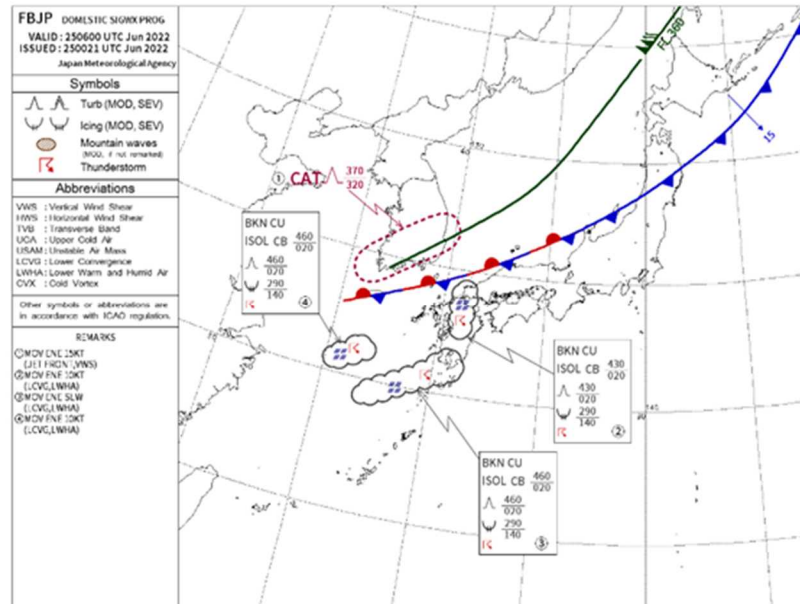


Figure 7: Domestic Significant Weather Prognostic Chart

(4) Radar Composite Map by Ground Weather Radar (Echo Top Height)

According to the radar composite map observed by the ground weather radar around the accident occurrence site (echo top height) (Figure 8), at 13:30, close to the time of the accident, a radar echo, whose cloud top height had developed from 5 km (16,404 ft) to 6 km (19,685 ft), was observed near the place where the accident occurred.

In the Aircraft's travel direction on the northeast side of the accident site, a radar echo, whose cloud top height had rapidly developed from a maximum 9 to 10 km, was observed.

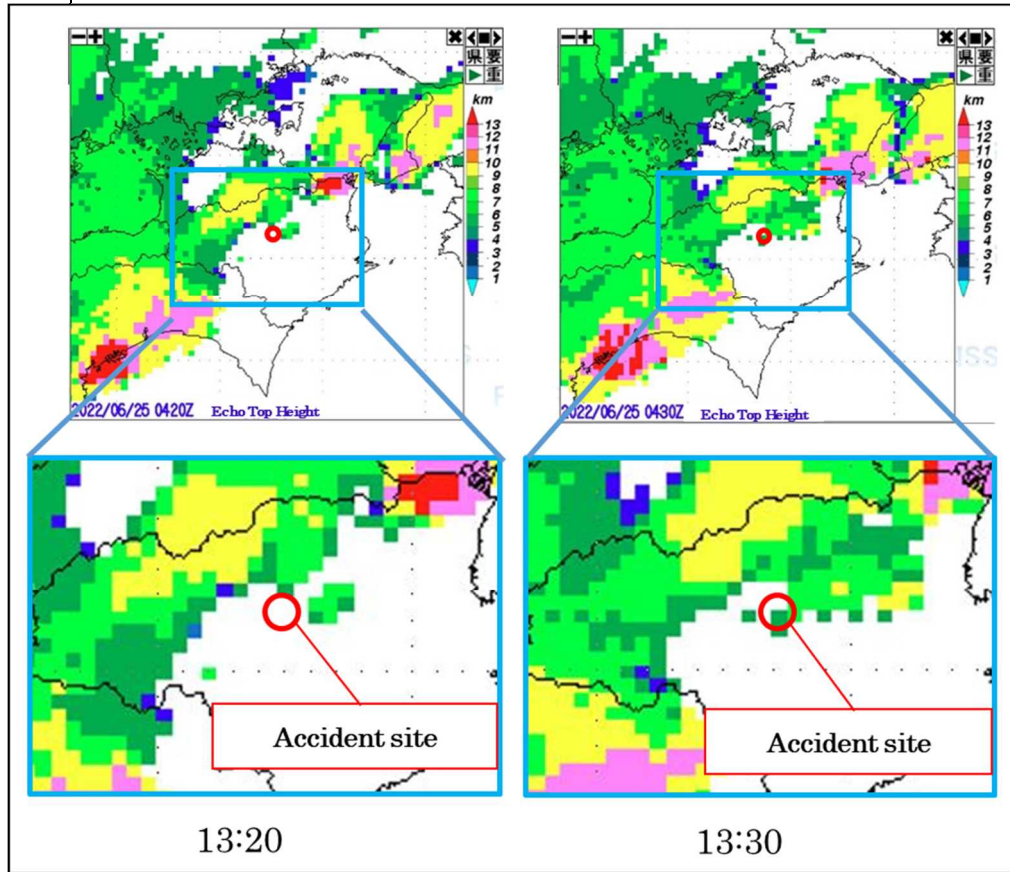


Figure 8: Radar Composite Map (Echo Top Height)

2.7 Additional Information

(1) FDR Records

According to the FDR records of the Aircraft (Figure 9), from 13:29:08 to 13:29:20, the recorded vertical acceleration changed between +0.2 G (see ① in Figure 9) and +2.1 G (see ② in Figure 9).

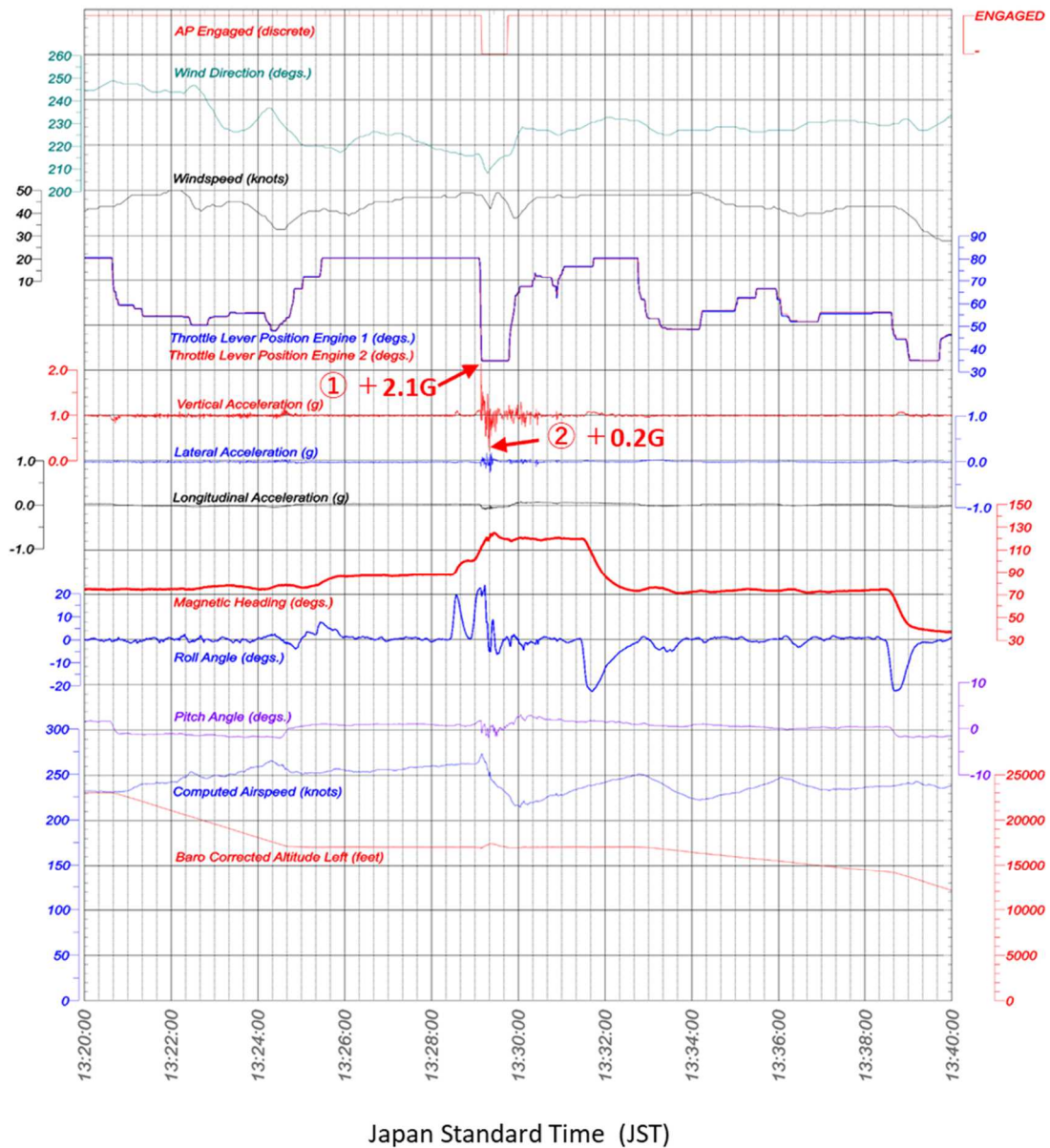


Figure 9: FDR Records

3. ANALYSIS

(1) Meteorological Information

The JTSB concludes that from the Radar Composite Map (Echo Top Height)(Figure 8), convective clouds*⁶ had most likely developed up to the cloud top height of 5 km (16,404 ft) to 6 km (19,685 ft) near the place where the accident occurred.

(2) The shaking of the Aircraft

The JTSB concludes that as the FDR records (Figure 9) show that the vertical acceleration changed between +0.2 and +2.1 G for 12 seconds from 13:29:08, at this time, the Aircraft was more likely flying just close to developed convective clouds, encountering an airflow disturbance due to convective clouds and being shaken violently.

(3) Circumstances at the time of cabin crew member's injury

*⁶ "Convective Clouds" refer to clouds that are formed when updraft develops vertically.

The JTTSB concludes that it is most likely that L2 sustains the injury for floating the body in mid-air and falling down on the floor in the state of getting out of the body balance when squatting and working in the galley in the aft side of the Aircraft due to the Aircraft was shaken violently while the Belt Sign was off.

(4) Judgement of Weather Information and Belt Sign Operation by Flight Crew Members

The JTTSB concludes that as the Aircraft was flying in clouds when this accident occurred, it was more likely difficult to find the clouds ahead and recognize their shape by visual outside watch.

At 13:28:25, in order to avoid the echoes displayed on the onboard weather radar, the PIC requested the ATC facility for the Aircraft heading changes and changed the Aircraft heading to the right, but 43 seconds after that, the Aircraft was shaken violently. From taking into account the speed of the Aircraft at that time, the distance between the point when the Aircraft started changing its heading and the point when the Aircraft was shaken was closing up to less than 5 nm as a result. In addition, as the PIC did not consider the effect of cross wind, the heading change angle was not sufficient. Afterwards, the PIC increased the angle of heading change following the assertion made by the FO, resulting in the two-time operations for the Aircraft heading change. In this way, when the PIC made an avoidance action, the Aircraft had been already close to the echoes, the heading change angle was not sufficient, and besides there were likely to develop convective clouds that were difficult to detect on the onboard weather radar, which were likely not to be able to secure proper distance from the developed convective clouds.

Besides, the flight crew members thought it would be possible to avoid the echoes by changing the Aircraft heading and considered the passengers' needs, therefore they had more likely left the Belt Sign off until the Aircraft encountered the strong vertical tremor. It is desirable for flight crew members to judge from the safer point of view when there is the possibility that an aircraft would be shaken.

4. PROBABLE CAUSES

The JTTSB concludes that as while the Belt Sign was off, the Aircraft encountered an airflow disturbance due to convective clouds and was shaken violently, which made the body of L2 float in mid-air when the L2 was squatting while working in the galley in the aft side of the Aircraft, resulting in getting out of balance to fall down on the floor and most likely sustaining the injury.

It is possible that the aircraft encountered airflow turbulence caused by convective clouds because of inadequate maneuvering to avoid them, and besides because it was difficult to detect developing convective clouds from onboard weather radar, the aircraft was likely not to be able to maintain an adequate distance from them.

5. SAFETY ACTIONS

<p>5.1 Safety Actions Required</p>	<p>It is desirable for the Company to make known the overview of this accident to all flight crew members in order to let them reconfirm how to avoid echoes and how to operate the Belt Sign.</p>
<p>5.2 Safety Actions Taken after the Accident</p>	<p>After the accident, the Company made known the overview of this accident to all flight crew members and let them reconfirm how to respond to the weather conditions change (including the use of onboard weather radar) and how to operate the Belt Sign.</p>