

AA2023-7

**AIRCRAFT ACCIDENT  
INVESTIGATION REPORT**

**Japan Transocean Air Co., Ltd.  
JA 07R K**

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 JAPAN TRANSOCEAN AIR CO., LTD. BOEING 737-800, JA07RK AT AROUND 11,300 M (FL 370) ABOUT 56 KM SOUTHEAST OF MIHO AIRPORT AT ABOUT 12:55 JST, OCTOBER 3, 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

<b>1.1 Summary of the Accident</b>	On Monday, October 3, 2022, while a Boeing 737-800, JA07RK, operated by Japan Transocean Air Co., Ltd., was flying from Naha Airport to Komatsu Airport, the aircraft was shaken, causing a cabin crew member to sustain an injury.
<b>1.2 Outline of the Accident Investigation</b>	On October 7, 2022, upon receipt of the notification of the accident occurrence, the Japan Transport Safety Board (JTSB) designated an investigator-in-charge and two other investigators to investigate this accident. An accredited representative of the United States of America, as the State of Design and Manufacture of the aircraft and engine involved in this accident, participated in the investigation. Comments on the draft Final Report were invited from parties relevant to the cause of the accident and the Relevant State.

### 2. FACTUAL INFORMATION

<b>2.1 History of the Flight</b>	According to the statements of the flight crew members and cabin crew members as well as the records of the Quick Access Recorder (QAR), the history of the flight is summarized as below. On October 3, 2022, at 11:22 Japan Standard Time (JST: UTC + 9hrs, unless otherwise stated all times are indicated in JST on a 24-hour clock), a Boeing 737-800, JA07RK, operated by Japan Transocean Air Co., Ltd., as a scheduled flight 36 of the Company, with 106 people on board, consisting of the Pilot in Charge (PIC), five other crew members, and 100 passengers, took off from Naha Airport (see Figure 1). In the cockpit of the aircraft, the PIC sat in the left seat as PF*1 and the
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\*1 "PF" and "PM" is a term for identifying a pilot from role sharing in an Aircraft controlled by two people, PF stands

First Officer (FO) in the right seat as PM\*1.

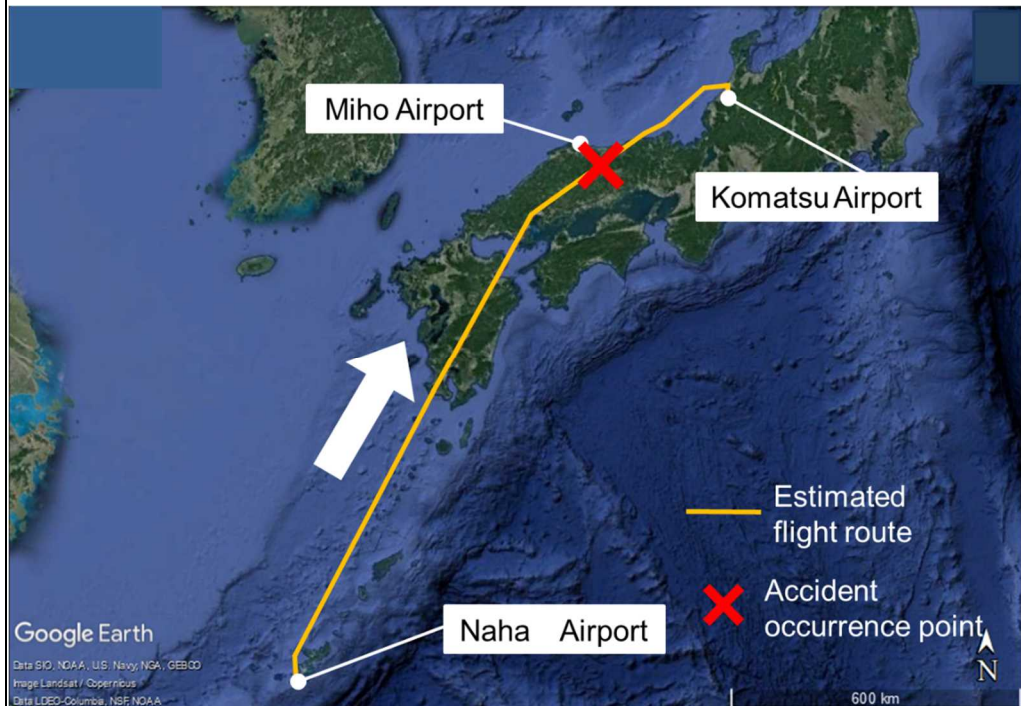


Figure 1: Estimated Flight Route  
(made with some additions to Google Earth)

At about 12:50, while cruising at the pressure altitude of 41,000 ft (Flight Level (hereinafter referred to as “FL\*2”) 410) where there was no cloud, the aircraft suddenly encountered a significant shaking (the 1<sup>st</sup> Shaking). Therefore, the PIC turned on the belt sign, and commenced to descend to FL 390 in order to avoid shaking. Even after reaching FL 390, the aircraft continued shaking, therefore, the PIC commenced to descend further to FL 370.

At about 12:54, the aircraft stopped shaking after reaching FL 370 to be in a stable condition, and as it was expected to encounter turbulence after the start of the descent to Komatsu Airport, the PIC turned off the seat belt sign to secure time for passengers to go to the lavatory, considering there were neither changes in wind that could be expected to cause turbulence nor clouds near the flight path that could cause turbulence. As the seat belt sign was turned off, the cabin crew member, who was injured in this accident (hereinafter referred to as “Cabin Crew A”), left the cabin attendant seat in the aft galley, and headed for passenger seats to attend to passengers (see Figure 2).

for Pilot Flying, mainly manipulates the Aircraft and PM stands for 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 200 represents altitude 20,000 ft.

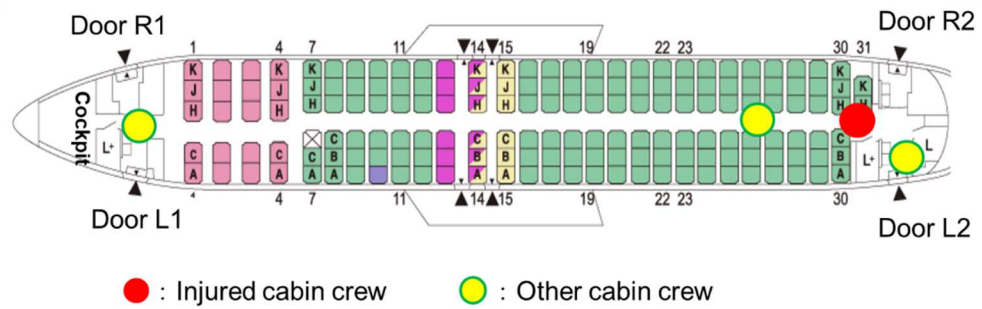


Figure 2: Location of Cabin Crew Members at the Time of the Accident

At about 12:55, when Cabin Crew A came to the aisle, the aircraft encountered significant shaking, being shaken from left to right (lateral tremor) again (hereinafter “the 2<sup>nd</sup> Shaking”). Due to this shaking, after hitting the wall on the left side of the aisle, Cabin Crew A was about to be thrown to the right side. Cabin Crew A grabbed the headrest of a passenger seat on the left side so as not to fall down to the right side, stood the ground with the right foot, and avoided falling down (see Figure 3).

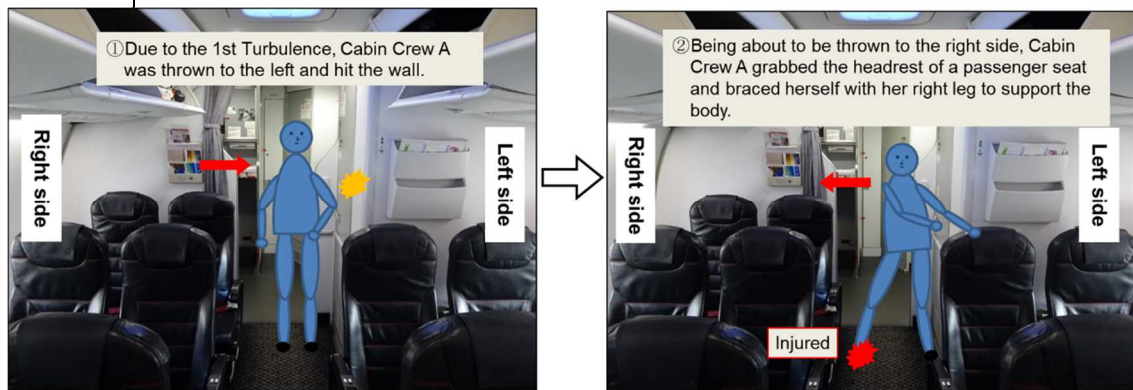


Figure 3: Cabin Crew A's Situation at the Time of the Accident  
(Image Based on the Statement)

Immediately after the 2<sup>nd</sup> Shaking occurred, again the seat belt sign was turned on, therefore, Cabin Crew A returned to the aft galley and took the attendant seat. When having stood the ground with the right foot, Cabin Crew A felt something wrong with the right foot, but judged that it would not have any problem to respond to an emergency and continued the duties. The aircraft continued the flight, and landed at Komatsu Airport at 13:28.

After the aircraft arrived at Komatsu Airport, the chief cabin crew and Cabin Crew A confirmed that Cabin Crew A was still able to fly. Then all the pilots and cabin crew of Flight 36 continued their work, and the aircraft departed for Naha Airport as Flight 37.

Feeling continuously discomfort in the right foot on duty in Flight 37, Cabin Crew A reported to the PIC before the aircraft's arrival at Naha Airport that Cabin Crew A felt something wrong when having stood the ground with the right foot at the time of encountering shaking on the previous flight, and continued to

	<p>feel it.</p> <p>Cabin Crew A was examined at a medical facility the next day, on October 4, 2022 to be diagnosed with a “suspected right pollex pedis sesamoid fracture.” On October 7, 2022, Cabin Crew A received a medical examination again to be diagnosed with a “right pollex pedis sesamoid fracture.”</p> <p>This accident occurred at about 12:55 on October 3, 2022, at an altitude of about 11,300 m (FL 370) about 56 km southeast of Miho Airport (Latitude 35°10'30"N, Longitude 133°41'58"E).</p>																										
<b>2.2 Injuries to Persons</b>	Cabin Crew A was seriously injured (a right pollex pedis sesamoid fracture).																										
<b>2.3 Damage to the Aircraft</b>	None																										
<b>2.4 Personnel Information</b>	<p>(1) Pilot in command: Age 54</p> <table border="0"> <tr> <td>Airline transport pilot certificate (Airplane)</td> <td>July 17, 2007</td> </tr> <tr> <td>Type rating for Boeing 737</td> <td>June 27, 1997</td> </tr> <tr> <td>Class 1 aviation medical certificate</td> <td></td> </tr> <tr> <td>Validity</td> <td>July 10, 2023</td> </tr> <tr> <td>Total flight time</td> <td>19,217 hours 14 minutes</td> </tr> <tr> <td>Total flight time on the type of the aircraft</td> <td>3,746 hours 36 minutes</td> </tr> </table> <p>(2) First officer: Age 27</p> <table border="0"> <tr> <td>Commercial pilot certificate (Airplane)</td> <td>August 9, 2019</td> </tr> <tr> <td>Type rating for Boeing 737</td> <td>March 4, 2022</td> </tr> <tr> <td>Instrument Flight Certificate (Airplane)</td> <td>June 18, 2020</td> </tr> <tr> <td>Class 1 aviation medical certificate</td> <td></td> </tr> <tr> <td>Validity</td> <td>November 7, 2022</td> </tr> <tr> <td>Total flight time</td> <td>525 hours 26 minutes</td> </tr> <tr> <td>Total flight time on the type of the aircraft</td> <td>283 hours 25 minutes</td> </tr> </table>	Airline transport pilot certificate (Airplane)	July 17, 2007	Type rating for Boeing 737	June 27, 1997	Class 1 aviation medical certificate		Validity	July 10, 2023	Total flight time	19,217 hours 14 minutes	Total flight time on the type of the aircraft	3,746 hours 36 minutes	Commercial pilot certificate (Airplane)	August 9, 2019	Type rating for Boeing 737	March 4, 2022	Instrument Flight Certificate (Airplane)	June 18, 2020	Class 1 aviation medical certificate		Validity	November 7, 2022	Total flight time	525 hours 26 minutes	Total flight time on the type of the aircraft	283 hours 25 minutes
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<b>2.5 Aircraft Information</b>	<table border="0"> <tr> <td>Aircraft type:</td> <td>Boeing 737-800</td> </tr> <tr> <td>Serial number:</td> <td>61485</td> </tr> <tr> <td>Date of manufacture:</td> <td>March 6, 2018</td> </tr> <tr> <td>Certificate of airworthiness:</td> <td>No.2018-006</td> </tr> <tr> <td>Validity:</td> <td>Period during which the Maintenance Management Manuals (Japan Transocean Air Co., Ltd.) approved pursuant to permissions under Article 113-2, Civil Aeronautics Act are applied.</td> </tr> <tr> <td>Total flight time:</td> <td>10,139 hours 50 minutes</td> </tr> </table>	Aircraft type:	Boeing 737-800	Serial number:	61485	Date of manufacture:	March 6, 2018	Certificate of airworthiness:	No.2018-006	Validity:	Period during which the Maintenance Management Manuals (Japan Transocean Air Co., Ltd.) approved pursuant to permissions under Article 113-2, Civil Aeronautics Act are applied.	Total flight time:	10,139 hours 50 minutes														
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<b>2.6 Meteorological Information</b>	<p>(1) Weather Data the Flight Crew Members Confirmed before the Flight</p> <p>① Domestic Significant Weather Prognostic Chart</p> <p>According to the forecasts at 09:00 and 15:00 on October 3, 2022 confirmed by the flight crew members before the flight, no weather phenomena that would cause the aircraft to be shaken such as turbulence greater than moderate one, were forecasted around the planned flight route including near the accident occurrence point (see Figure 4).</p>																										

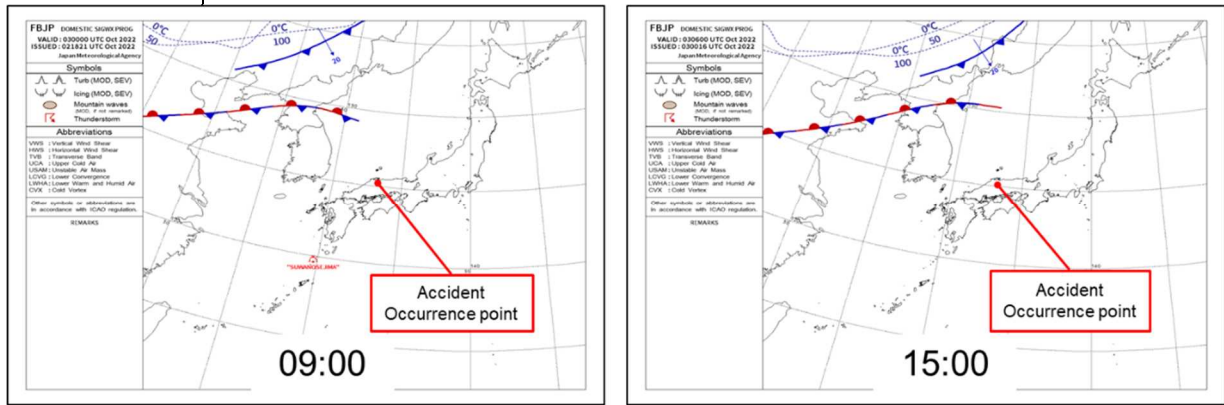


Figure 4: Domestic Significant Weather Prognostic Chart on October 3, 2022 (FBJP)  
(Partially added to the weather data provided by the JMA)

② Flight Route Forecast Cross Section Chart

According to the flight route forecast cross section chart at 12:00 on the day of the accident, neither the occurrence of vertical wind shear nor clouds that might cause the aircraft to be shaken were forecasted (see Figure 5).

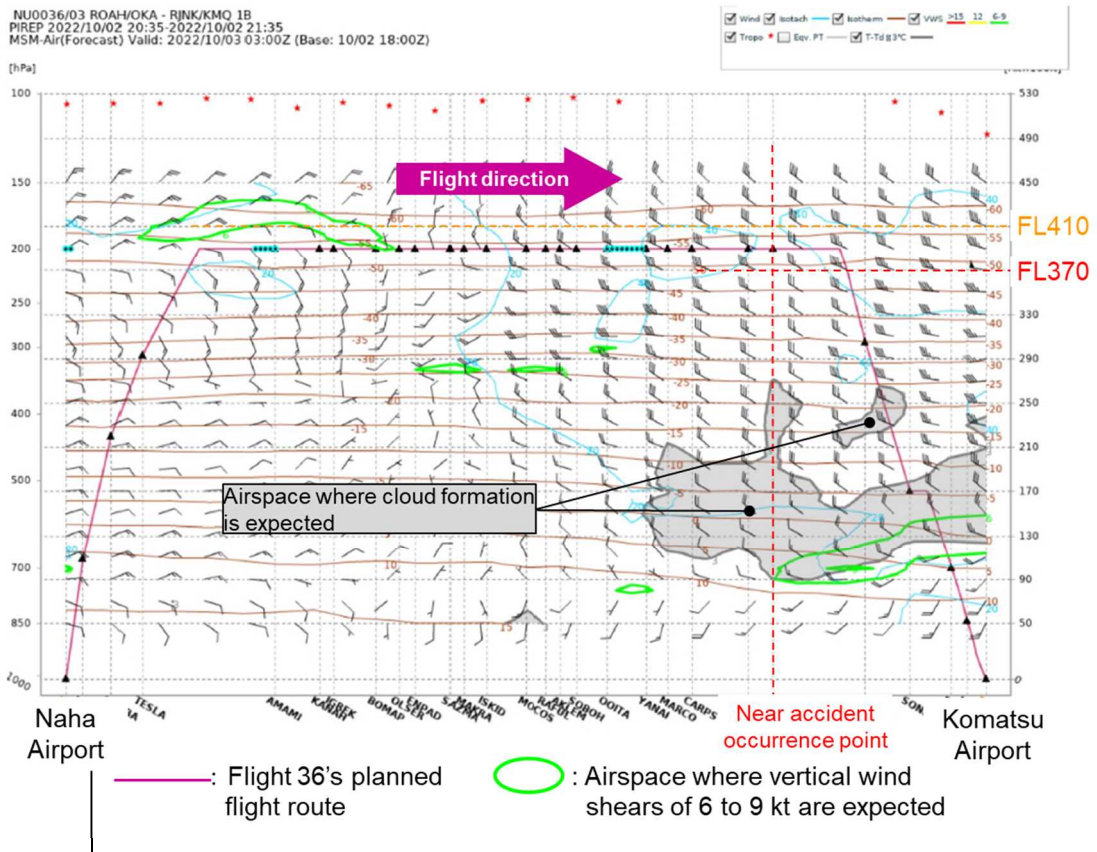


Figure 5: Flight Route Forecast Cross Section Chart at 12:00 on October 3, 2022  
(Partially added to the data provided by Japan Transocean Air Co., Ltd.)

(2) Observation Analysis

① Domestic Significant Weather Analysis Chart

According to the domestic significant weather analysis charts at 12:00 and 15:00 on October 3, 2022, no weather phenomena that would cause the aircraft to be shaken were analyzed around the accident occurrence point (see Figure 6).

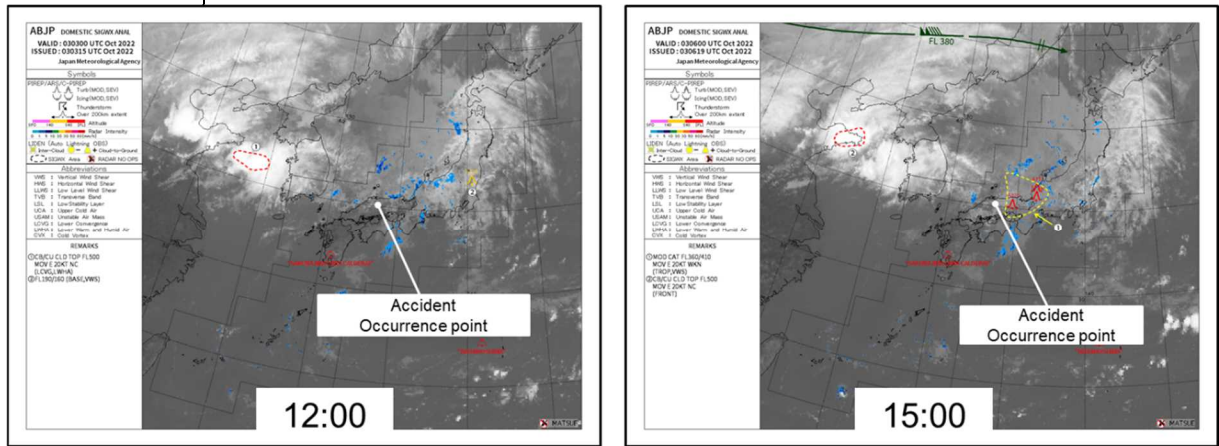


Figure 6: Domestic Significant Weather Analysis Chart on October 3, 2022 (ABJP)  
(Partially added to the weather data provided by the JMA)

② Hourly Atmospheric Analysis Chart Horizontal Cross Section (FL 370)

According to the hourly analysis chart vertical cross section for FL 370 at 13:00 on the day of the accident, around the accident occurrence point, vertical wind shear (the area enclosed by the light brown line in the figure) that might produce moderate turbulence was not analyzed (see Figure 7).

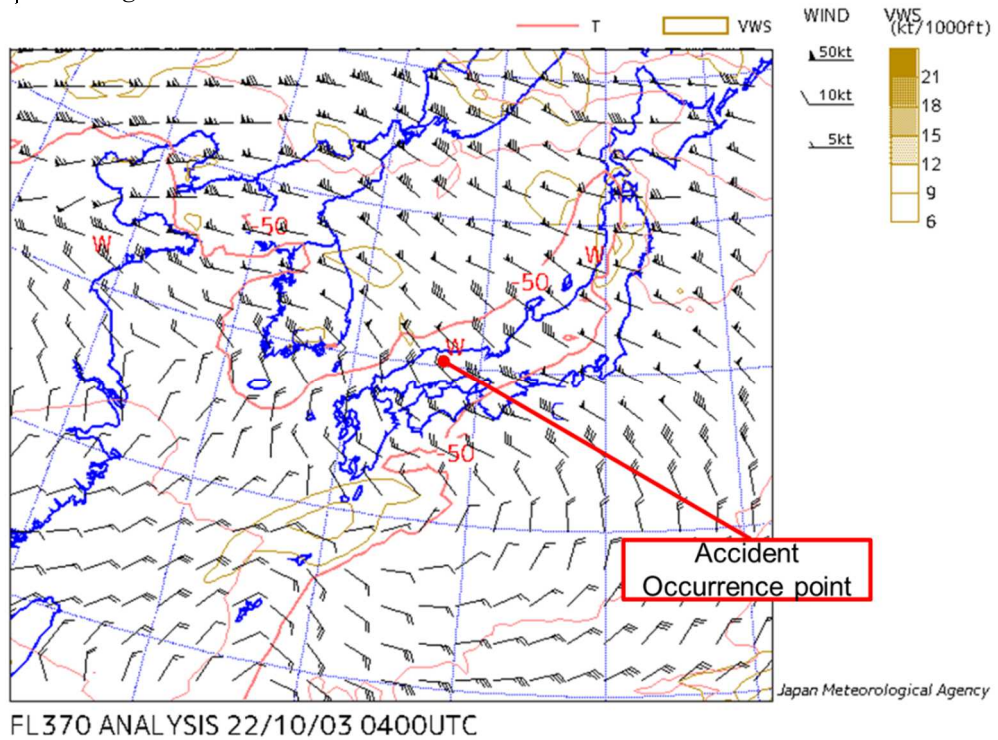


Figure 7: Hourly Analysis Chart Horizontal Cross Section (FL 370) at 13:00 on  
October 3, 2022  
(Partially added to the weather data provided by the JMA)



	<p>③ Others</p> <p>Before the time of the accident, there was no report about encountering turbulence from other aircraft to the air traffic control facility which had been in charge of the accident aircraft. In addition, according to the statement of the PIC, when the accident occurred, the aircraft was flying outside clouds, there were no clouds that could produce turbulence around the flight route, and in the cockpit of the aircraft, neither the flight instrument display nor clouds area on the airborne weather radar that would be a sign of turbulence were observed.</p>
<p><b>2.7 Additional Information</b></p>	<p>(1) QAR Records</p> <p>According to the QAR records of the aircraft, the wind velocity before the accident was approximately 65 kt, from 12:55:15 to 12:55:17, it decreased from 56 kt to 46 kt, and then at 12:55:18, then, it increased to 65 kt (Figure 8①). During this period, the wind direction was stable with a true bearing of about 330°.</p> <p>The bank angle remained roughly at 0°, but it changed to 2.8° to the left at 12:55:13, to 0.7° to the left at 12:55:14, to 1.1° to the left at 12:55:15, to 5.3° to the left at 12:55:16, to 4.6° to the left at 12:55:17, to 3.5° to the right at 12:55:18, to 5.1° to the right at 12:55:19, and to 1.6° to the right at 12:55:20, then it remained generally between 1° to the left and 1° to the right (Figure 8②).</p> <p>As to the nose heading, a magnetic bearing of 055° had been maintained until 12:55:15, it temporarily became a magnetic bearing of 057° between 12:55:16 and 12:55:17, then at 12:55:18, it became a magnetic bearing of 055° (Figure 8③).</p> <p>Repeated were small changes in vertical acceleration within the range of 0.9 to 1.1 G, the vertical acceleration changed within the range of 1.0 to 1.2 G from 12:55:15 to 12:55:16, and it changed from 0.6 G → 1.0 G → 0.6 G → 1.1G → 1.0 G between 12:55:16 and 12:55:18 (See Figure 8④).</p> <p>The lateral acceleration relative to the aircraft was maintained nearly 0 G until 12:55:13. After that, at 12:55:14, it changed to 0.04 G to the right, at 12:55:15, to 0.07 G to the left, between 12:55:16 and 12:55:17, to almost 0 G, and at 12:55:18, to 0.02 G to the right (Figure 8⑤).</p> <p>The outside air temperature (SAT) gradually increased while the aircraft was decreasing its flight altitude, but no significant change was found.</p> <p>The flight altitude was maintained at FL 410 until 12:51:11, then the aircraft started the descent. After maintaining FL 390 for 20 seconds from 12:52:35, the aircraft descended again, reached FL 370 at 12:54:06, maintaining FL 370 until 12:57:19.</p>

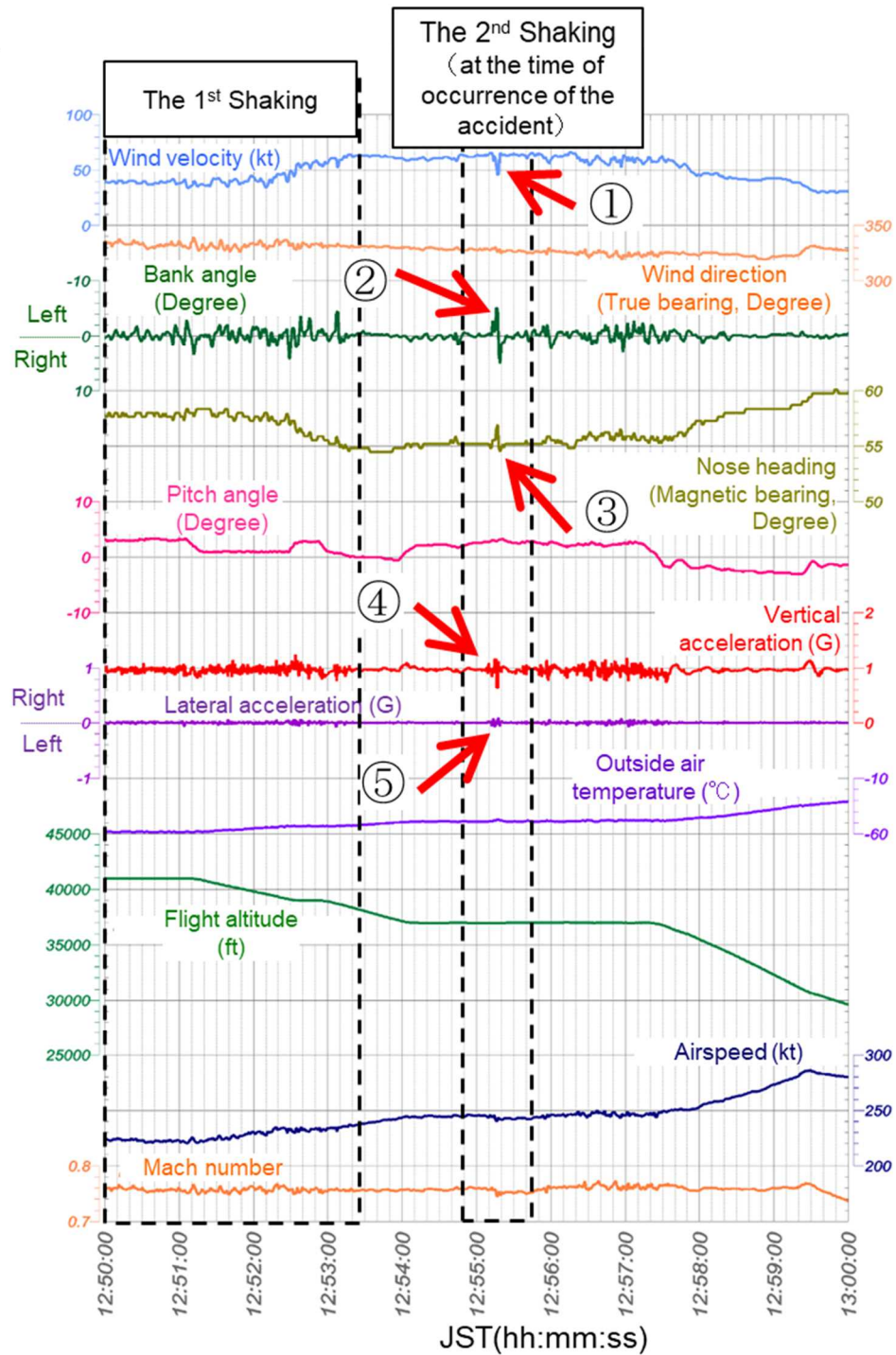


Figure 8: Information Recorded on QAR

(2) Effects of Wake Turbulence from Other Aircraft

According to the radar track records, around the aircraft, there were no flying airplanes whose wake turbulence might have an effect on the aircraft.

(3) Pre-Flight Information Sharing among Crew Members

The PIC had informed the cabin crew members that the seat belt sign would be turned on earlier than usual as the aircraft was expected to encounter turbulence after cruising flight and starting to descend toward Komatsu Airport.

(4) Preventive Measures against Injuries due to Unexpected Aircraft's

	<p><b>Shaking by the Company</b></p> <p>The Company regularly carries out a campaign to prevent from injuries due to unexpected aircraft's shaking in cooperation with the flight crew members, cabin crew members and Airport operation department.</p> <p>The campaign, which was carried out in June 2022, it was encouraged to have a mutual conversation among crew members to confirm the aircraft shaking by use of risk prediction, and preventive measures against injuries due to shaking were disseminated.</p> <p>Besides, in the cabin crew member initial training about the responses to an unexpected shaking, the Company provided them with the knowledge regarding how to hold their bodies by holding onto seats and handrails, etc., at the time of encountering an unexpected shaking.</p> <p>Furthermore, in the regular training (once a year) in which all cabin crew members were mandated to participate, the Company provided them with the opportunity to reconfirm the knowledge about responses to an unexpected shaking as well as made known appropriately about how to prevent injuries so as to keep their bodies from floating in the mid-air by holding onto passenger seats, etc., at the time of encountering shaking.</p>
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### 3. ANALYSIS

<p>(1) Injury to Cabin Crew Member</p>	<p>The JTSTB concludes that it is probable that while the seat belt sign was turned off and Cabin Crew A was walking in the aisle to attend to passengers, the 2<sup>nd</sup> Shaking was encountered, when Cabin Crew A, who was about to be thrown to the right. Cabin Crew A stepped hard on her right leg to keep from falling down to the right, but a heavy load added with the vertical acceleration and lateral acceleration caused by the aircraft shaking was momentarily placed on the sole of the right foot, resulting in the injury to Cabin Crew A. From the QAR records, this shaking was caused by a combination of changes in bank angle of the aircraft and nose heading (yaw (heading) movements of the aircraft), and the aft cabin section, where Cabin Crew A had been, was the place that would be significantly affected by lateral inertia caused due to yaw movements of the aircraft as being far from the rotation center of the yaw movements of the aircraft. Therefore, lateral acceleration larger than the recorded acceleration on QAR had probably occurred around the place where Cabin Crew A was.</p> <p>Cabin Crew A was able to avoid falling down or hitting passenger seats, etc. by grabbing the headrest of a passenger seat quickly was because disseminating information on how to respond to shaking in the regular campaigns and trainings in the Company more likely made a difference to it. It is desirable for the Company to continue to implement the ongoing preventive measures against the injuries due to shaking.</p>
<p>(2) Occurrence of the 2<sup>nd</sup> Shaking</p>	<p>The JTSTB concludes that according to the QAR records, when the 2<sup>nd</sup> Shaking occurred, the wind velocity temporarily decreased, and at the same time, changes in bank angle and nose heading occurred, therefore, the aircraft shaking at this time was probably caused due to fluctuations in wind velocity.</p>
<p>(3) Predictability about Encountering Turbulence</p>	<p>The JTSTB concludes that the flight crew members highly probable failed to predict the 2<sup>nd</sup> Shaking for the following reasons.</p>

- According to the weather data confirmed before the flight, no weather phenomena that might cause the aircraft to be shaken were forecast around the 2<sup>nd</sup> Shaking occurrence point.
- Before the accident occurred, there was no report about encountering turbulence from other aircraft flying nearby around the aircraft.
- There were no clouds that could produce turbulence around the 2<sup>nd</sup> Shaking occurrence point, and no changes in wind direction and velocity, etc. that would be a sign of turbulence were confirmed on the flight instrument in the cockpit.
- In the significant weather analysis and hourly atmospheric analysis charts indicating the weather conditions when the accident occurred, there were no analysis data of weather phenomena that would cause the aircraft to be shaken around the 2<sup>nd</sup> Shaking occurrence point. Therefore, the temporary decrease in wind velocity at the time of the 2<sup>nd</sup> Shaking was probably a local weather change that would not be shown in the weather data

#### 4. PROBABLE CAUSES

The JTSA concludes that the probable cause of this accident was most likely that as the aircraft was shaken violently in lateral direction during cruising, a heavy load was applied on the sole of the right foot of Cabin Crew A who was standing in the aisle in the aft cabin section, resulting in the serious injury to Cabin Crew A.

The reason why the aircraft was shaken laterally was probably because the aircraft flew through the airspace where the wind velocity changed locally, which was not forecast according to the weather data the flight crew members confirmed in advance.

#### 5. SAFETY ACTIONS

<b>5.1 Safety Actions Required</b>	As described in ANALYSIS, it is desirable for the Company to continue to implement their ongoing preventive measures against similar accidents.
<b>5.2 Safety Actions Taken after the Accident</b>	<p>The Company took following safety actions after the accident.</p> <p>(1) Issuing alerts to the Company’s cabin crew members and thoroughly reimplementing the measures</p> <p>The Company issued the cabin safety information that described the following contents (dated on October 21, 2022) to all cabin crew members, as well as issued alerts and implemented again the measures thoroughly in the “Injury Prevention Campaign for Passengers and Cabin Crew Members” (from November 1 to 30 in 2022), in which the flight crew members, cabin crew members, and Airport operation department collaborated.</p> <ul style="list-style-type: none"> <li>① Overview of this accident</li> <li>② Points to protect yourself at the time of encountering unexpected shaking in the cabin</li> <li>③ Judgement about the suspension / discontinuation of in-flight services under unstable condition.</li> <li>④ Importance about the specific communication and conversation of confirmation to recognize the situation properly</li> </ul> <p>(2) All cabin crew members shall be mandatorily required to receive the practical training about how to hold their bodies at the time of encountering unexpected shaking in the cabin crew member initial</p>

	training and regular training.
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