

3. Case of close call incidents, aircraft accidents, etc. (related to wake turbulence and wrong approach to a runway, etc.)

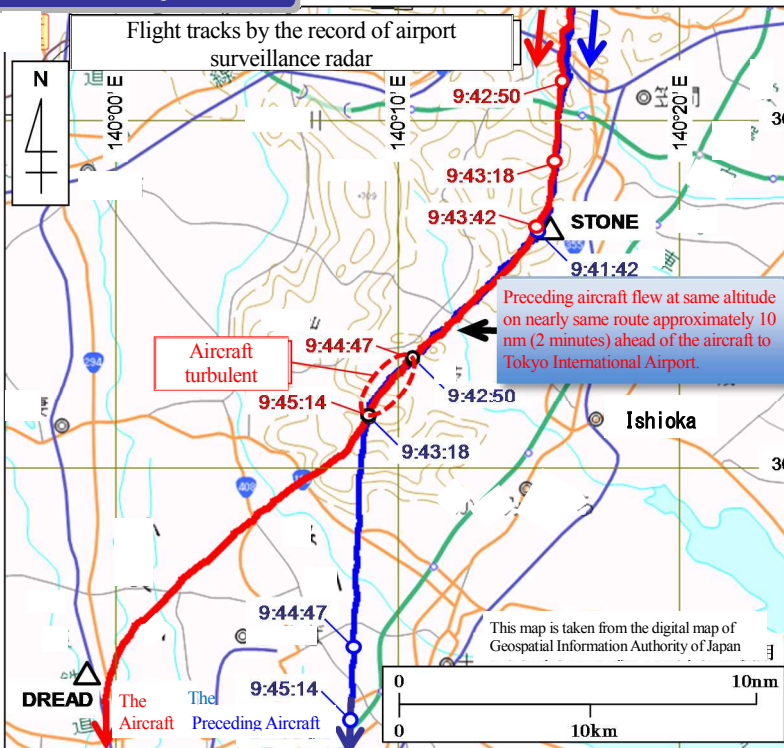
Case 1 of wake turbulence (aircraft accident)

The aircraft encountered strong wake turbulence from the preceding aircraft when descending, and two cabin attendants who were in the aft galley fell over

Summary: On Tuesday, April 29, 2014, at 09:16 Japan Standard Time (JST: unless otherwise stated, all times are indicated in JST, UTC+9h), an Embraer ERJ170-100STD, operated by Company A. took off from Yamagata Airport as the scheduled flight 1252 of code sharing with Company B. At around 09:45 when the aircraft was descending toward Tokyo International Airport, it encountered turbulence at an altitude of approximately 10,600 ft over Ishioka City, Ibaraki Prefecture. Two cabin attendants were injured who were in the aft galley.

There were 39 people on board, consisting of the pilot in command (PIC), three other crew members and 35 passengers. The aircraft was not damaged.

Estimated Flight Route



Progress of the flight

09:16	took off from Yamagata Airport
	The aircraft was flying at an altitude of 11,000 ft, following the standard arrival route of Tokyo International Airport by autopilot (hereinafter referred to as "A/P").
09:44:23	Tokyo radar approach control facility instructed the aircraft to descend to an altitude of 8,000 ft and to reduce the speed to 230 kt.
09:44:37	The aircraft began to descend from the altitude of 11,000 ft.
09:44:47	The vertical acceleration rate of the aircraft started to fluctuate little by little.
09:44:57	The aircraft started to roll and veer to the left, and a large fluctuation in vertical acceleration and lateral acceleration rates began.
09:44:59	Lateral acceleration rate to the left of the aircraft became approximately 0.32G (the maximum value during this flight).
09:45:03	The A/P of the aircraft was disengaged manually.
09:45:04~05	The left bank angle of the aircraft became approximately 58° (the maximum value during this flight).
09:45:04~10	The control column of the aircraft was pulled a little, and the control lever of the aircraft was pushed to the right intermittently.
09:45:13	The A/P of the aircraft was engaged.
09:45:15	Fluctuation of vertical acceleration rate of the aircraft almost stopped.

The Preceding Aircraft

Airbus A340-600

Maximum takeoff weight:

Approximately 368 tons

Wake turbulence classification: Heavy aircraft



The Aircraft

Embraer ERJ170-100STD

Maximum takeoff weight:

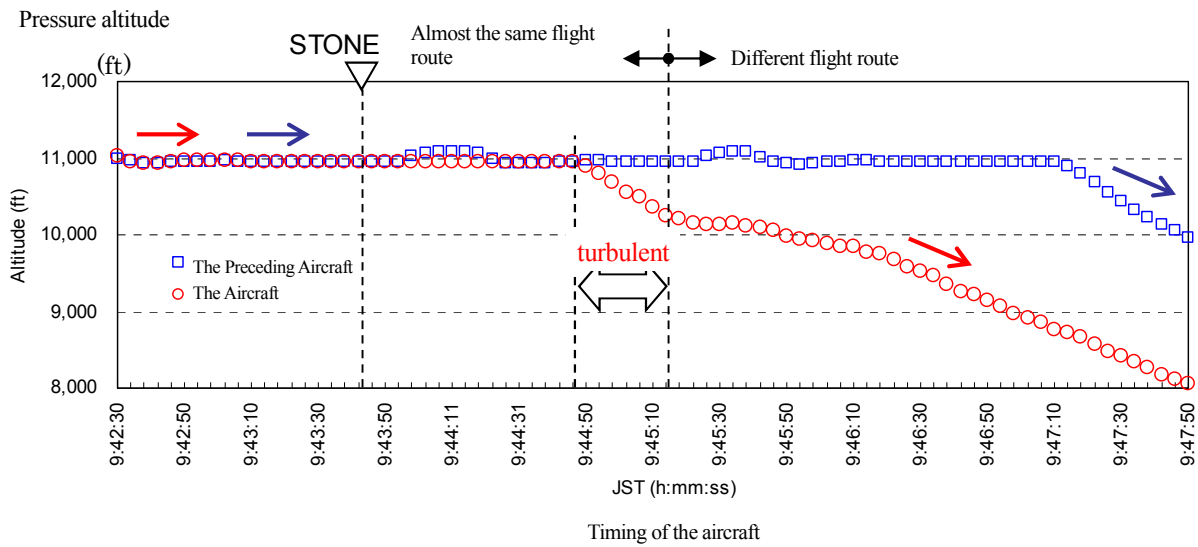
Approximately 35 tons

Wake turbulence classification: Medium aircraft



Timing of changes in vertical acceleration of the aircraft

Illustration of assumed flight altitude

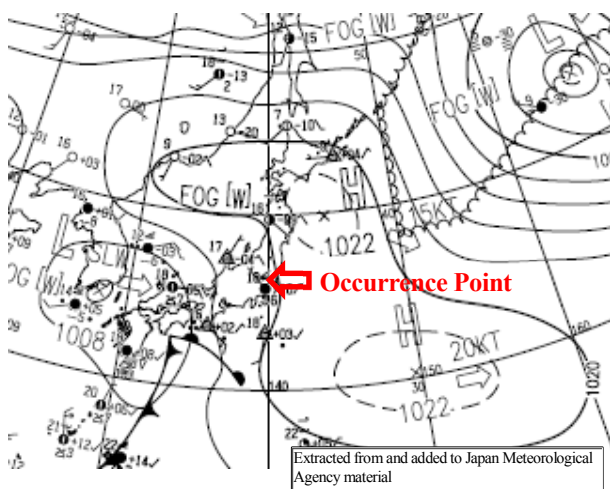


Smoothed altitude after correction of the atmospheric pressure by the record of airport surveillance radar

According to the records of the flight recorder and the radar track records of Tokyo radar approach control facility, the vertical acceleration of the aircraft started to fluctuate little by little at around 09:44:47 when it began to fly approximately 200 ft below the preceding aircraft on the same flight route as the preceding aircraft, and after the large fluctuation began at around 09:44:57, when it was flying approximately 600 ft below the preceding aircraft. After that the fluctuation almost stopped at around 09:45:15 when the aircraft began to fly on a different route from the preceding aircraft after its left turn.

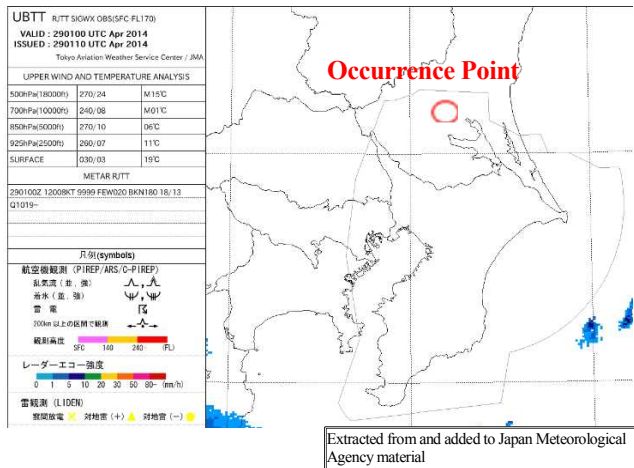
Meteorological information

Asia Surface Synoptic Chart (09:00 on April 29)



Extracted from and added to Japan Meteorological Agency material

Regional Significant Weather Prognostic Chart (Kanto) (10:00 on April 29)



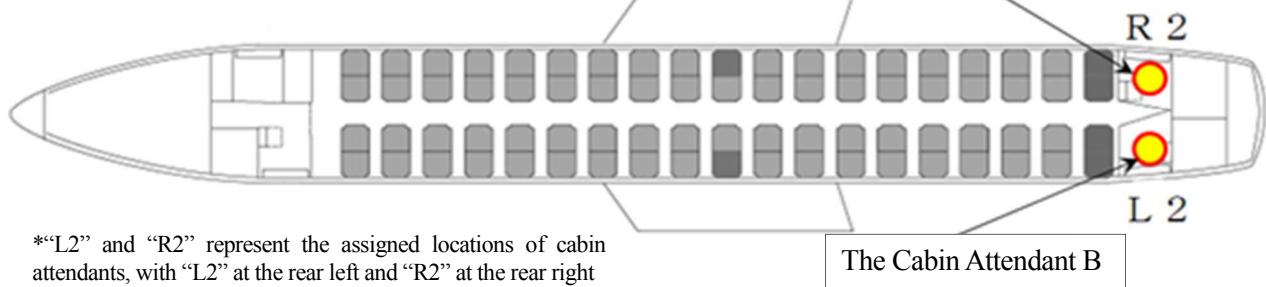
Extracted from and added to Japan Meteorological Agency material

According to the Asia Surface Synoptic Chart at 09:00 and the Regional Significant Weather Prognostic Chart (Kanto) at 10:00 on the day of the accident, the airspace where the accident occurred was at the edge of a high atmospheric pressure area moving eastward at 20 kt, with no effects of a low atmospheric pressure approaching from the south coast of Shikoku island, and no bad weather was observed.

In addition, according to the Hourly Atmospheric Analysis Charts* at 09:00 and 10:00, the wind was blowing at a low speed about 5 kt in the airspace where the accident occurred, and no vertical wind shear was observed. The temperature was stable at approximately minus two degrees. *See the investigation report

Status of injured persons

Locations of the Injured when the Accident Occurred.



*"L2" and "R2" represent the assigned locations of cabin attendants, with "L2" at the rear left and "R2" at the rear right

The Cabin Attendant A

When the Cabin Attendant A entered the aft galley from the front side after cabin safety check, she took the R2 handset and monitored the call. After receiving the information on the estimate time of passing an altitude of 10,000 ft and instruction to carry out cabin safety checks the cockpit, and when she tried to place back the handset, the aircraft was strongly shaken and she collided with the R2 door; subsequently, collided with the Cabin Attendant B who was strongly flung from the L2 side, and fell down.

The Cabin Attendant B

Immediately after the Cabin Attendant B received the notification from the cockpit with the L2 handset about the estimate time of passing an altitude of 10,000 ft, and when she was about to make an announcement to the passengers, the aircraft was strongly shaken and her body was strongly flung to the R2 side, and then collided with the Cabin Attendant A who was at R2.

Analysis of cause of accident

Relation to Meteorological Conditions

It is highly probable that the meteorological conditions around the accident airspace were that there was no cloud associated with bad weather, calm winds and no atmospheric turbulence.

Relation to Wake Turbulence

Wake turbulence is believed to decay earlier if there is an atmospheric turbulence; however, it is probable that the strong wake turbulence that the Aircraft encountered persisted longer than usual, because of the stable meteorological condition with calm winds in the airspace.

History of the Shaking of the Aircraft

The Aircraft started to descend upon receiving an instruction from the Tokyo radar approach control facility, and as the vertical acceleration of the Aircraft started to fluctuate little by little at an altitude of approximately 10,800 ft around 09:44:47, it is probable that the Aircraft started to be affected by the wake turbulence from the Preceding Aircraft around that time.

This big shake continued until it recorded the vertical acceleration of approximately 1.64G at 09:45:07, and then turned toward convergence. Therefore it is probable that the Aircraft encountered the strong wake turbulence from around 09:44:57 until around 09:45:07 while it was descending from an altitude of approximately 10,600 ft to approximately 10,400 ft.

Separation behind the Preceding Aircraft

The separation between both aircraft was approximately 10 nm according to the radar track records. Therefore certain that there was enough separation exceeding 5 nm, which is the Minimum Separation by the wake turbulence control procedure*.

*The Wake Turbulence Control Procedure : In the case that the air traffic controller is using radar, the minimum separation when a medium aircraft follows a preceding heavy aircraft is 5 nm.

Involvement of the Flight Crew Members

Even though the flight crew members needed to be careful of the calm wind condition where the wake turbulence persists longer than usual, it is probable that it was difficult to predict such shaking of the Aircraft that would cause passengers or cabin attendants to fall, as there had been very few examples of report of encounter with a strong wake turbulence from an aircraft flying approximately 10 nm ahead, and it is probable that it was not a situation where they were required to change the flight route or altitude to avoid it, nor instruct the passengers and cabin attendants to fasten their seatbelts in preparation for the shaking of the Aircraft.

While it is probable that a big shake of the Aircraft caused the injuries of the cabin attendants, it is probable that the flight crew members conducted the recovery operation of the unexpected unusual attitude of the Aircraft properly.

Probable Causes : It is probable that this accident was caused by the shaking of the Aircraft which encountered the strong wake turbulence from the Preceding Aircraft while the Aircraft was descending; accordingly, two cabin attendants in the aft galley fell down and one of them was seriously injured.

It is probable that the strong wake turbulence that the Aircraft encountered persisted longer than usual because of the stable weather condition with calm wind.

In order to Prevent Recurrence

➤It is probable that it would be beneficial for pilots to keep in mind the content described in guidance* in the event wake turbulence is encountered, and review the operation continuously to appropriately recover the fuselage attitude in case of unexpected encountering with a wake turbulence.

*Advisory Circular No.90-23G "Aircraft Wake Turbulence" published by the Federal Aviation Administration, U.S. Department of Transportation

The investigation report of this case is published on the Board's website (issued on May 28, 2015)

http://www.mlit.go.jp/jtsb/eng-air_report/JA211J.pdf

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

Mini explanation About wake turbulence

Wake turbulence from aircraft is the spiraling flow of air that occurs from the difference in air pressure above and below the wings. Wake turbulence is said to exist in a belt that generally has a length of 9.3km (5nm) from front to back in the case of large aircraft, and air traffic control conducts control so that aircraft do not enter a minimum interval that is stipulated based on the size of the preceding aircraft and the aircraft that follows it.

