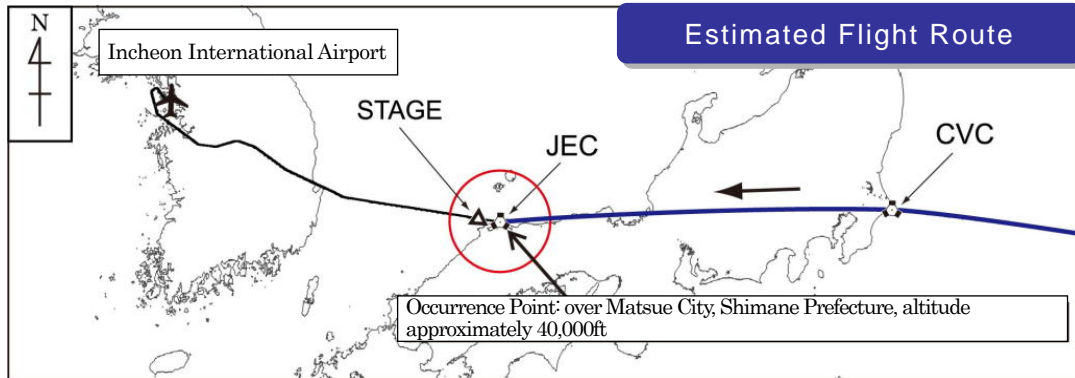


## Case 4

# Serious injuries suffered by passengers from the shaking of the aircraft encountering severe atmospheric disturbance

Summary : On Tuesday August 21, 2012, an Airbus A330-300, operated by Company A, took off from Honolulu International Airport (the United States of America) for Incheon International Airport (the Republic of Korea), as a scheduled flight. While flying at approximately 40,000 ft over Matsue City, Shimane Prefecture, around 15:17 Japan Standard Time (JST: UTC+9hr, unless otherwise stated, all times are indicated in JST on a 24-hour clock), the aircraft was shaken. Two passengers were seriously injured and one passenger was slightly injured.

There were 221 people on board, consisting of the pilot in command (PIC), 14 other crew members and 206 passengers. The aircraft was not damaged.



### Events leading to the Accident

15:14:17 Communications in Japanese were exchanged between the Tokyo Area Control Center (ACC) and another aircraft stating that JEC (Miho VORTAC(\*8)) was out of service due to a lightning strike.

Aircraft	Cockpit	Passenger cabin	Weather conditions
15:16:14 A small change of the vertical acceleration started.	15:16:24 Route Captain (*9) set the speed selector at M0.78.		15:16:30 The wind had been blowing from the right rear direction of the Aircraft at an average speed of 16kt, it began to change in a counter-clockwise direction.
15:16:30 A relatively large change in vertical acceleration began.	The route captain turned on the seat belt selector.		15:16:33 The static air temperature began to change.
15:16:36 The Aircraft's angle of attack (*10) increased suddenly, but there was no change to the pitch angle.	(*8...VORTAC: combined VOR and TACAN navigational radio facility)		15:16:36 The wind direction changed to blow directly against the Aircraft.
15:16:38 The speed of the Aircraft became M0.872, temporarily exceeding the maximum operating speed limit:M0.86.	Causing the over speed warning to sound.		15:16:38 The wind speed became 34kt.
The entire aircraft began to be lifted up due to a strong updraft.			15:16:40 The static air temperature increased rapidly by 4°C, and this high value was maintained for approximately 15 seconds.
15:16:40 The vertical acceleration became 1.88G, the highest value for this flight.	(*9..."Route Captain"as referred to by the Company A is a pilot in a three-member crew formation who assumes the PIC's duties in place of the regular Captain only during cruising flight.)		The wind began to change in a counter-clockwise direction.
15:16:41 The rate of climb became approximately 3,300 ft/min.	(*10...When a wing is located in a uniform air current, it is the angle formed by the direction of this current and the chord line.)		15:16:42 The wind became a crosswind from the left, and the wind speed became 20kt.
15:16:42 The vertical acceleration became 0.04G, which was the greatest change during this flight.			

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15:16:46  
The Aircraft continued to climb.

The altitude deviation alert sounded.

At the initial shaking, Passenger A was thrown into the air and fell forcefully to the floor.

15:16:44  
Cabin attendants made a Passenger Address (PA) regarding shaking of the aircraft and fastening of seat belts.

15:16:45  
The wind speed became 2kt.

15:16:48  
The PIC took operations over from the route captain and disengaged the A/P (\*11).

15:16:46  
The wind became a tailwind, and the wind speed began to increase.

The pitch angle of the aircraft changed rapidly to -6.3°, while the vertical acceleration became -0.09G, the lowest value during this accident.

15:16:54  
The PIC pushed the side stick forward (the direction to lower the nose).

When Passenger B took off her seat belt to assist Passenger A, Passenger B was thrown into the air and fell as the aircraft shook once again.

15:16:55  
As the roll angle varied within the range from 30.2° on the right side to 17.9° on the left side, the pitch angle reached a maximum of +14.8°.

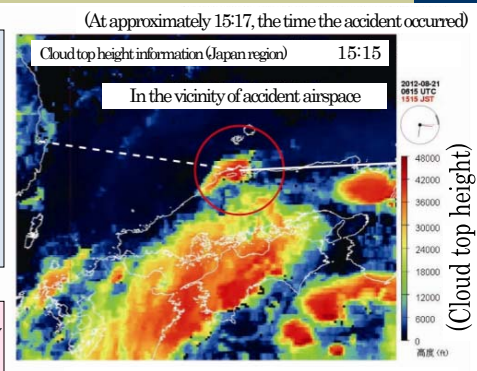
The input of roll and pitch by the sidestick on the PIC side changed greatly. (~15:17:30)

15:16:55  
While remaining as a tailwind, the wind speed increased to a maximum of 52kt.

(\*11...Auto Pilot)

### Relation to Meteorological Conditions

**Effect of Cumulonimbus**  
Cumulonimbus were generated rapidly in the vicinity of the accident airspace from approximately one hour before the accident occurred, with a cloud top height exceeding the Aircraft's flight altitude of 40,000 ft. Moreover, it was recorded in the Cockpit Voice Recorder that immediately before the accident occurred, JEC was out of service due to a lightning strike and that other aircraft flying around the Aircraft had been communicating with the Tokyo ACC to avoid significant weather conditions.



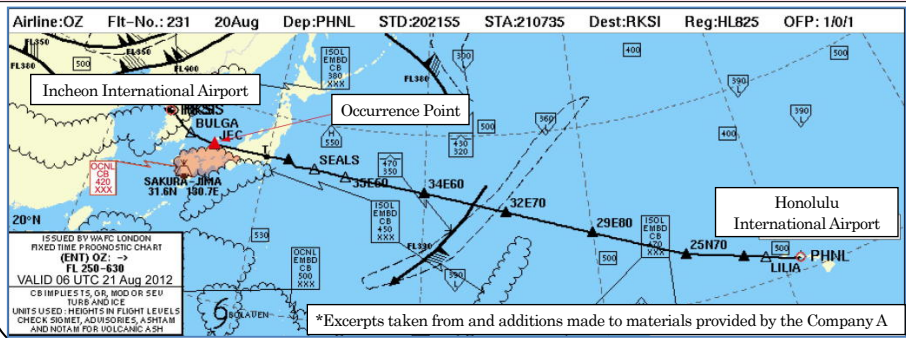
It is highly probable that cumulonimbus to which the PIC and the Route Captain should pay attention existed in the vicinity of the accident airspace.

### Recognition of Cumulonimbus

It is probable that the PIC and the Route Captain did not recognize the existence of cumulonimbus as they did not sufficiently monitor the weather conditions and instruments or notice that the weather radar was off because they opened up manuals, etc. concentrating on confirming the operation guidelines while assuming various phases in the period of 30 minutes leading up to the accident.

According to the statements of the PIC, although it was forecast in the pre-flight weather briefing that there would be a cloud top height of 42,000ft around the flight route, no significant weather conditions such as clouds was forecast on the flight route including the accident point; however there was a possibility that the nearby clouds expanded to the site of the accident.

It was necessary for the PIC and the Route Captain to continually obtain the most current weather information from the Operation Control Center and other organizations during flight and also to pay close attention to the weather conditions on the flight route by watching outside and using the weather radar.



The Significant Weather Prognostic Chart for International Aviation issued by the London WAFC and confirmed by the PIC in the pre-flight briefing.

## Disengagement of A/P

It is possible that the severe shaking of the aircraft was occurred resulting from the PIC's operation after disengaging the A/P.

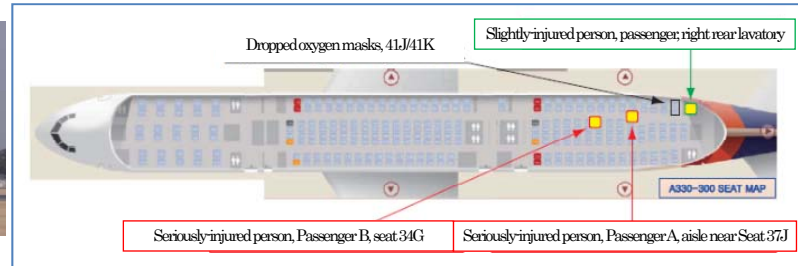
It is probable that the PIC experienced difficulties in stabilizing the Aircraft by manual control while at a high altitude and in the midst of atmospheric disturbances.

The regulations of the Company A specify that the flight crew should keep the A/P on when encountering severe turbulence.

It is possible that if A/P had not been disengaged, there may not have been such large changes in the pitch angle.



The aircraft



Position of injured persons at the time of the accident

**Probable Causes** : It is highly probable that in this accident, serious injury was sustained by a passenger walking in the rear aisle due to the severe shaking of the Aircraft, and that serious injury was sustained by another passenger seated nearby when the passenger removed the seat belt in order to help the injured passenger, the Aircraft shook severely again at that moment.

It is probable that the initial severe shaking of the Aircraft was a result of the Aircraft passing through or nearby cumulonimbus, due to the PIC and the Route Captain failing to notice that the weather radar was off, and encountering atmospheric disturbances with severe changes in wind direction and speed coupled with strong updrafts. It is possible that the next shaking of the Aircraft may have been influenced by the PIC's control operations after disengaging the A/P to stabilize the aircraft.

It is probable that the reason for the PIC and the Route Captain failing to notice that the weather radar was off was that their monitoring of the weather conditions and instruments was insufficient.

## In order to Prevent Recurrence

### Safety Actions taken by Company A after the accident occurred

>The Company notified its flight crew members of this case along with the following items as points for enhancement of safety.

- We strongly recommend to brief turbulence information during a joint briefing and perform the safety procedures.
- Try to get real time weather through the information of ATC turbulence, weather radar and your eyes.
- Perform the severe turbulence procedures with cabin crew when severe turbulence is expected or encountered.
- Captain should make PA to relieve anxiety of passengers due to turbulence.
- Make and maintain GOOD CRM (Crew Resource Management).

>The Company notified its cabin attendants of this case along with the following items as points for enhancement of safety.

- When the seat belt sign is on, continuously monitor that passengers are fastening their seatbelts no matter how serious the turbulence is.
- Cabin crew make an immediate cabin announcement to provide passengers with instructions for appropriate action in the case of turbulence even the other announcement is being already made.
- Ensure the policy and associated procedures regarding turbulence level. Please refer to CCM 2.10.
- When the seat belt sign is on, senior cabin crew contacts captain to check the time of configuration of the turbulence.
- Recently the number of unexpected turbulence has increased due to unstable air. Please always secure cabin.

### Safety Actions taken by the company that designed and manufactured the aircraft

> A clear description of "Overspeed Recovery" was inserted into the FCOM (Flight Crew Operating Manual), stating that in the event of excessive speed, it is necessary to immediately set the speed brakes lever to full and monitor the status of thrust reduction while maintaining A/P.

The investigation report of this case is published on the Board's website (issued on Jul. 25, 2014).

[http://www.mlit.go.jp/itsb/eng-air\\_report/HL8258.pdf](http://www.mlit.go.jp/itsb/eng-air_report/HL8258.pdf)

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