AA2015-5

AIRCRAFT ACCIDENT
INVESTIGATION REPORT

JAPAN AIRLINES CO., LTD.
J A 6 5 4 J

May 28, 2015

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.

Norihiro Goto
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

CABIN ATTENDANTS INJURIES BY THE SHAKING OF THE AIRCRAFT JAPAN AIRLINES CO., LTD., BOEING 767-300, JA654J AT AN ALTITUDE OF APPROXIMATELY 16,000 FT ABOUT 95 KM SOUTHEAST OF GIMPO INTERNATIONAL AIRPORT (KOREA) AT 17:33 JST, SEPTEMBER 12, 2014

April 24, 2015

Adopted by the Japan Transport Safety Board

Chairman	Norihiro Goto
Member	Shinsuke Endoh
Member	Toshiyuki Ishikawa
Member	Sadao Tamura
Member	Yuki Shuto
Member	Keiji Tanaka

1. PROCESS AND PROGRESS OF THE INVESTIGATION

According to the provisions of Annex 13 to the Convention on International Civil Aviation, the Japan Transport Safety Board (JTSB) was delegated the whole part of the conducting the accident investigation by Republic of Korea, the State of Occurrence, on September 24, 2014. Therefore, the JTSB has decided to conduct the accident investigation. On September 25, 2014, the JTSB designated an investigator-in-charge and two investigators to investigate the accident. An accredited representative of the Republic of Korea, as the State of Occurrence involved in this accident, participated in the investigation. Although this accident was notified to the United States of America, as the State of Design and Manufacture of the aircraft involved in this accident, the United States did not designate its accredited representative.

Comments were invited from parties relevant to the cause of the accident and relevant States.

2. FACTUAL INFORMATION

2.1 History of the Flight

The history of the flight is summarized below, based on the statements of the Pilot-In-Command (PIC), First Officer (FO), Cabin Attendants (CAs) and interpreters, and records of the flight recorder and Air Traffic Control (ATC) communication.

On September 12, 2014 at 15:50 (Japan Standard Time (JST) and Korea Standard Time (KST), UTC + 9. The same hereinafter), a Boeing 767-300, registered JA654J, operated by Japan Airlines Co., Ltd. as the scheduled flight 93 of the company, took off from Tokyo International Airport for Gimpo International Airport (Korea) with a total of 230 persons on board: the aircraft including the PIC, 11 crewmembers and 218 passengers. The PIC sat in the left seat as the Pilot Monitoring (PM: pilot mainly in charge of duties other than flying) and the FO sat in the right seat as the Pilot Flying (PF: pilot mainly in charge of flying).

The PIC, having received information before the departure that a cumulonimbus (CB) area existed over the west sea of the Korean peninsula, instructed cabin crewmembers to finish cleanup, and to be seated 30 minutes prior to landing. During its flight, however, he obtained information (refer to 2.6(2)) from the operation support staff of the company at Gimpo International Airport that no CB to be avoided was observed on its approach course. In response to this, he informed cabin crewmembers that he would turn on the seat belt sign as usual at an altitude of 10,000 ft, around 15 minutes prior to landing.

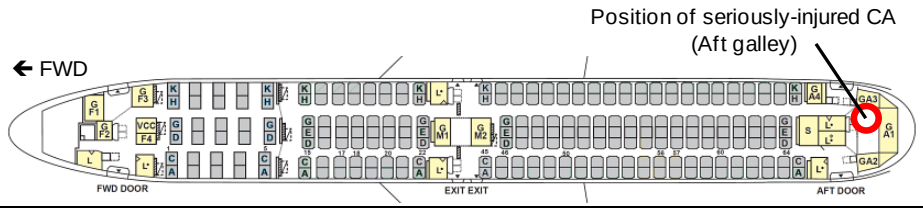
At 17:22, the aircraft commenced descent from Flight Level (FL) 380 (38,000 ft), then the flight crewmembers were instructed by ATC to reach FL160 by GUKDO (waypoint).

The flight below 30,000 ft was in thin clouds. The flight crewmembers set the gain and antenna tilt angle of the airborne weather radar to auto positions and also set the range in 40 nm observing within the range equivalent around 5 minutes in time. To avoid a weak echo area, they turned the aircraft to the right (east) with ATC permission. After clearing the echo area, they were instructed by ATC to proceed direct to GUKDO.

Although no weather echo was observed around GUKDO, at 17:33, a clear visible cloud came into sight nearby with no sufficient time to avoid, and the aircraft entered it. At that moment, shaking of large amplitude considered nearly TB4 [*1] continued for around three seconds. The PIC was informed that no passengers sustained injuries, while several cabin crewmembers and interpreters did.

A vertical acceleration of approximately +1.5 G continued for around two seconds, and momentarily it changed to −0.2 G, then +1.3 G (+: moving upward) when the aircraft encountered strong shaking. There was a little change of pitch angle. The autopilot and autothrottle remained engaged during the shaking.

Before the large shaking, CAs had completed services and were

	preparing for landing. Since shaking of the aircraft gained its momentum from around 17:28, CAs and interpreters in the aft galley took their seats temporarily although the seatbelt sign was not lit on. When they resumed their work after the shaking subsided, they suddenly encountered a violent vertical shaking, by which cabin crewmembers were thrown into the air to hit the ceiling and one of them fell onto the floor on her back. As a result, she was seriously injured. The atmosphere being stabilized after clearing clouds, the PIC turned on the seatbelt sign at 10,000 ft as usual and continued descent. The aircraft landed at Gimpo International Airport at 17:51. The accident occurred at 17:33 on September 12, 2014, near GUKDO, about 95 km southeast of Gimpo International Airport (37°01'43" N, 127°38'05" E), at an altitude of approximately 16,000 ft. (See figure 1 and 2) 
2.2 Injuries to Persons	Serious injury: one CA Minor injury: a total of six people (four CAs and two interpreters)
2.3 Damage	None
2.4 Personnel Information	PIC Male, Age 48 Airline transport pilot certificate (Airplane) November 15, 2002 Type rating for Boeing 767 October 4, 2011 Class 1 aviation medical certificate Validity: January 9, 2015 Total flight time 9,243 hr 56 min Total flight time on the type of aircraft 1,834 hr 46 min FO Male, Age 49 Commercial pilot certificate (Airplane) May 15, 1990 Type rating for Boeing 767 April 3, 2000 Instrument flight certificate December 6, 1990 Class 1 aviation medical certificate Validity: December 7, 2014 Total flight time 10,924 hr 09 min Total flight time on the type of aircraft 8,461 hr 40 min
2.5 Aircraft Information	(1) Type: Boeing 767-300 Serial number: 40366, Date of manufacture: January 17, 2011 Certificate of airworthiness: No. 2011-005 Category of airworthiness: Airplane, Transport T Total time in service: 15,003 hr 44 min (2) The Aircraft was equipped with flight recorders (a Flight Data Recorder (FDR) and a Cockpit Voice Recorder (CVR)). As it was obvious that the data on the CVR had been overwritten, the CVR was not removed from the Aircraft.

2.6 Meteorological Information	(1) Weather conditions confirmed before the flight The Korean Peninsula area was covered by high pressure system from the north, and there were no low pressure system or fronts which might imply bad weather. Although jet stream of about 100 kt in FL390 was expected from the Korean Peninsula to the Kinki district of Japan, bad weather such as clear air turbulence or convective clouds were not expected around Seoul. According to the Pilot Report (PIREP) of the company's preceding flight, weak turbulences (TB2 *1) were reported at 13:25 in clouds the altitude of which were from 24,000 to 23,000 ft and from 7,000 to 5,000 ft during the descent towards Gimpo International Airport. (2) Weather information provided during the flight At 16:43, during cruising flight, cloud condition provided from the operation support staff at Gimpo International Airport was as below. *Some isolated CB has been developed around west of GUKDO, over Seoul and over Gimpo Airport. But now it tends to go weak. No significant CB observed on your approach course and no need to deviate.* (3) Weather conditions at the time of the accident According to the hourly analysis chart (127.5° East vertical cross section) of 17:00 and 18:00 of the Japan Meteorological Agency, weak Vertical Wind Shear (VWS) existed in the upper layer, however, it was not at the altitude of the accident. According to the upper-laid observation weather chart (500 hPa, 700 hPa and 850 hPa) of 09:00 and 21:00 of the Japan Meteorological Agency, the Korean Peninsula area had been covered with the rear surface of the cold air trough. Although the center of the cold air had moved to the east, it was under the condition that cold air stayed as about −10 °C at around 500 hPa. According to the images of the Terminal Doppler Weather Radar (TDWR) installed in Incheon International Airport (Korea), small echoes had been scattered to the west of GUKDO (123 km southeast of Incheon TDWR), these echoes attenuated once. However, they began to grow up near GUKDO from past 17:00. (See Figure 3 and 4)

*1 "TB_" refers to intensity of the turbulence used in the company. "TB2" means "Light turbulence"; Food service may be conducted and little or no difficulty is encountered in walking. "TB4" means "Moderate turbulence"; Food service and walking are difficult.

3. ANALYSIS

3.1 Involvement of Weather	Yes
3.2 Involvement of Pilots	Yes
3.3 Involvement of Airplane	No

3.4 Analysis of Findings	(1) It is probable that the operation support staff of the company at Gimpo International Airport, based on the images of Inchon TDWR that scattered echoes of clouds shown in the east of GUKDO were attenuating, judged the aircraft would not need to deviate because no convective clouds which might give significant impact on the flight were observed along the approach course before 16:43 when the staff sent the information to the aircraft. However, convective clouds were redeveloping near GUKDO after 17:00. (2) Judging from the fact that significant change of vertical acceleration was observed at 17:33 when the aircraft was about to level off at FL160 around GUKDO after its descent, it is highly probable that the aircraft was strongly shaken as it encountered turbulence by the convective clouds, causing cabin crewmembers thrown into the air to hit the ceiling, and one of them fell onto the floor on her back to sustain a severe injury. (3) It is highly probable that the pilots had difficulty in visually identifying the convective clouds in a timely manner due to restricted visibility during descent through thin clouds. In addition to that, the airborne weather radar did not show echoes along their flight course. Therefore, it is also highly probable that there was no sufficient time to avoid the clouds. It is probable that followings are the reasons why the airborne weather radar did not show echoes along their flight course. The aircraft descended at the rate of approximately 2,800 ft/min (with the airspeed at about 300 kt, descent angle of about 5°) to follow the ATC instruction to reach FL160 by GUKDO. The airborne weather radar automatically changes the tilt upward in accordance with the decrease of altitude of the aircraft for the purpose of reducing ground clutters when the tilt mode is set to the auto mode. Therefore, it is probable that the pilots were unable to capture the echoes of the convective clouds in its early developing stage which existed in its flight direction (forward and downward of the aircraft). (4) At the time of occurrence of the accident, the aircraft was under such conditions as follows: (i) The cabin services to passengers had already finished. (ii) The aircraft was in clouds and was jolted after passing around 30,000 ft. (iii) They had once deviated to avoid weak weather echo. Judging from these, taking into account that a certain period of time had passed since they received the weather information, the PIC and PM should have considered to take preventive measures such as to survey the radar echo along its flight direction (forward and downward of the aircraft) by positively using the airborne weather radar manually tilting it and illuminate the seatbelt signs earlier to be on the safe side.

4. PROBABLE CAUSES

In this accident, it is highly probable that the aircraft was strongly shaken because it encountered turbulence when flying at around 16,000 ft, causing cabin crewmembers thrown into the air to hit the ceiling, and one of them fell onto the floor on her back to sustain a severe injury.

It is highly probable that the turbulence the aircraft encountered was caused by the redeveloped convective clouds after once shrinking. It is probable that the pilots were unable to capture the echoes of the convective clouds in their early developing stages which existed in its flight direction (forward and downward of the aircraft) due to having set the antenna tilt angle of the airborne weather radar to auto mode.

5. ACTIONS TAKEN

The company notified their flight crewmembers of the features and the limitations of the airborne weather radar, and taking into account of these notified them to bring attention to the timing of illuminating the seatbelt signs.

See Figure 1: Estimated Flight Route
See Figure 2: Records of the FDR
See Figure 3: Hourly Analysis Chart (vertical cross section)
See Figure 4: Radar Observation Data

Figure 1 Estimated Flight Route

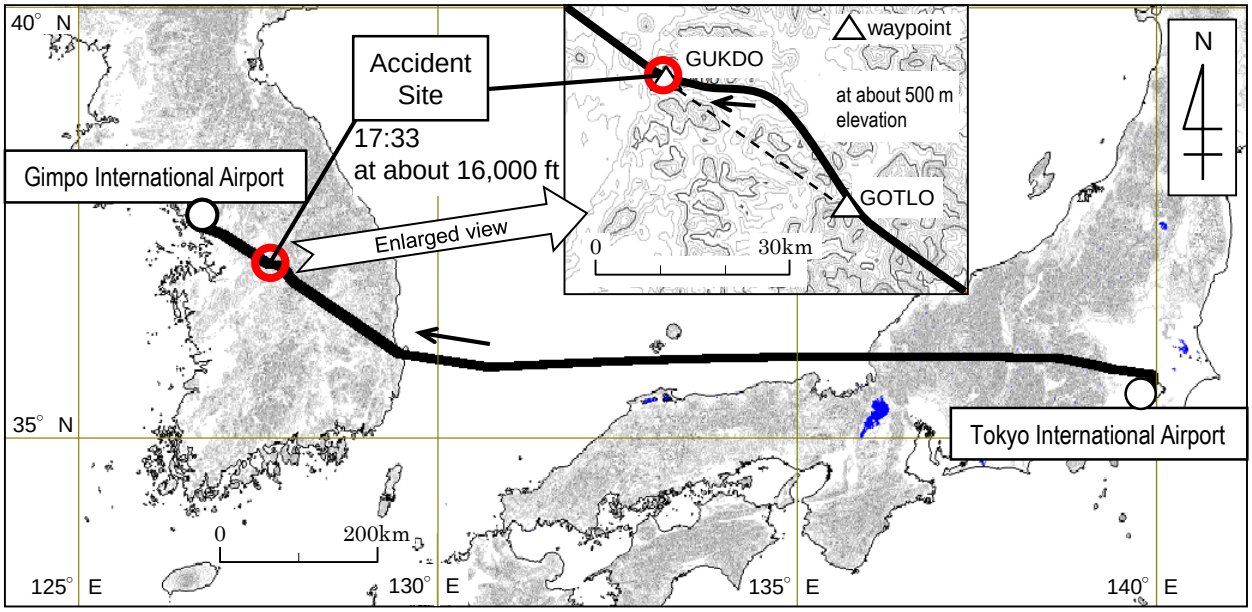


Figure 2　Records of the FDR

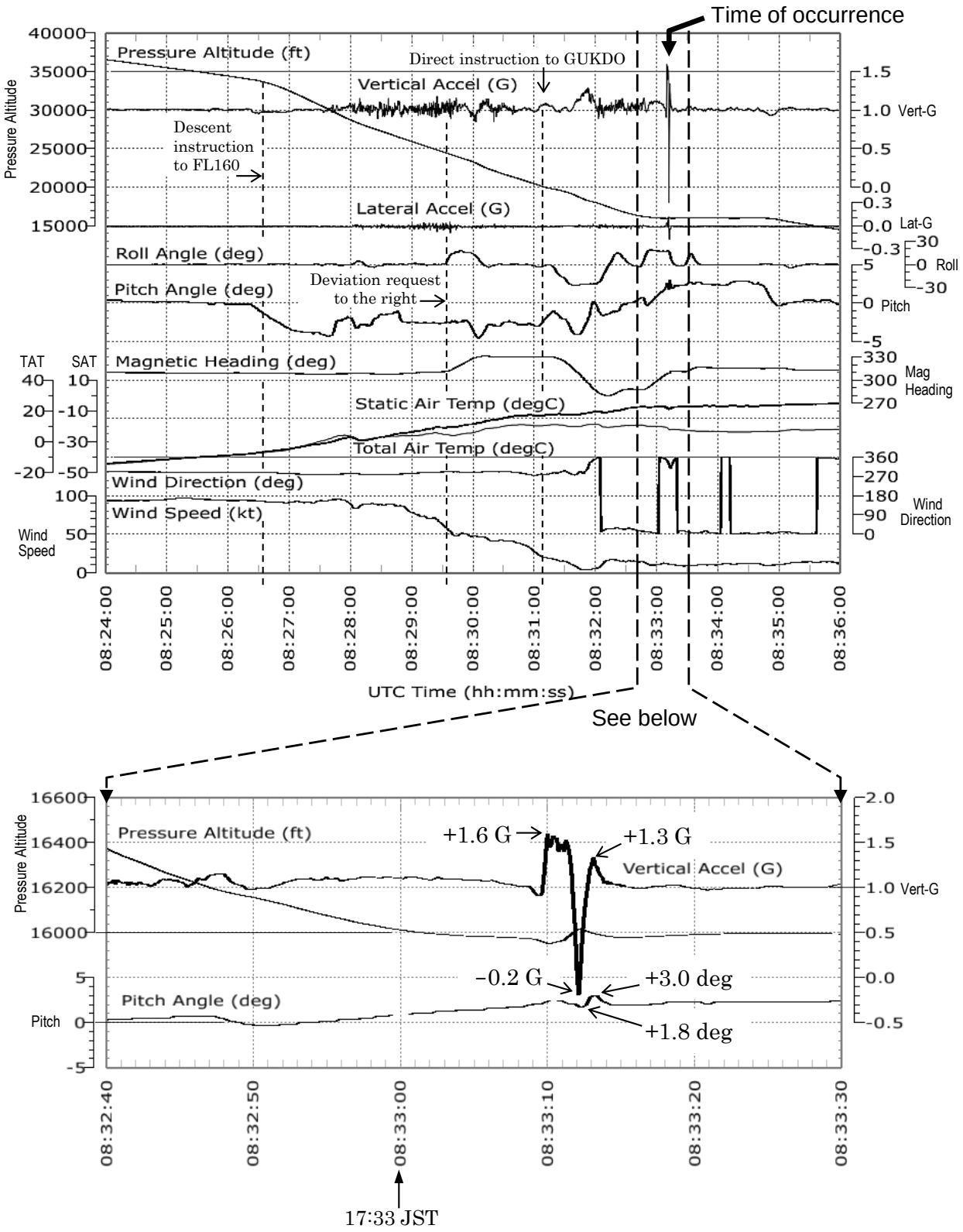


Figure 3　Hourly Analysis Chart (vertical cross section)

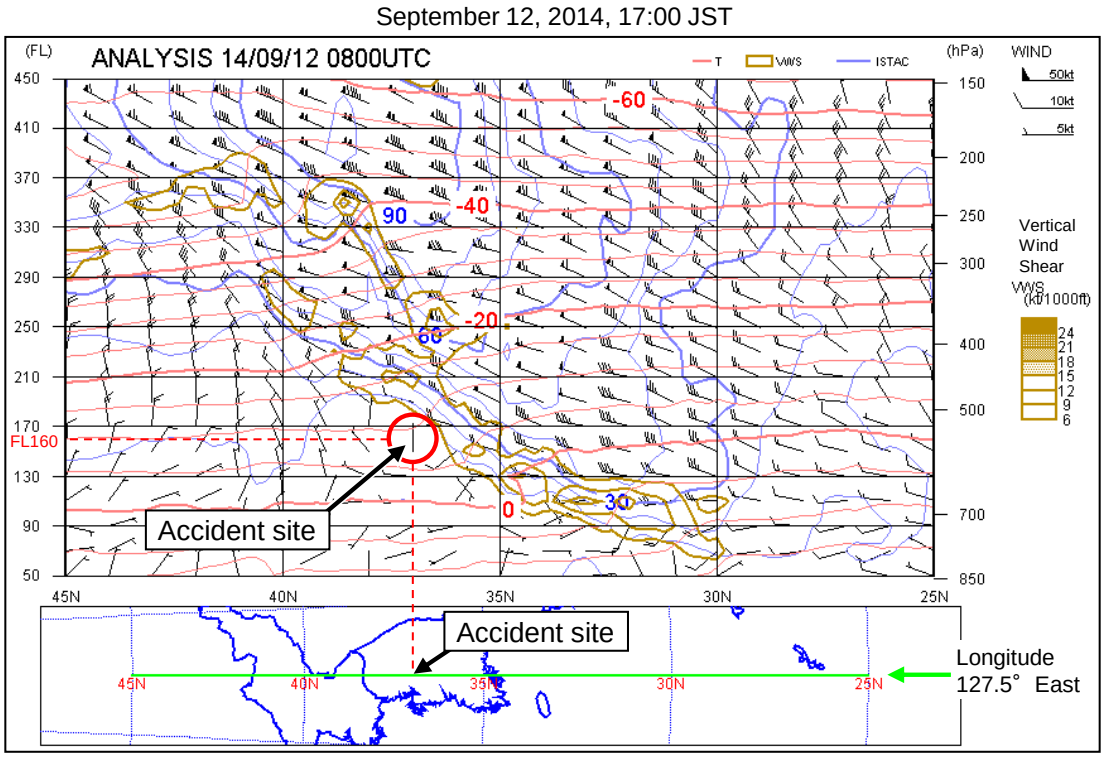
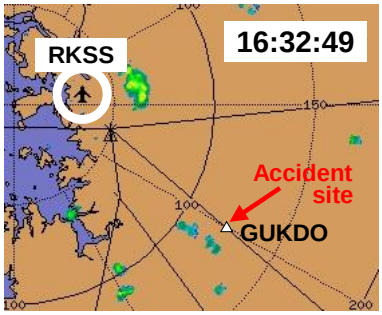
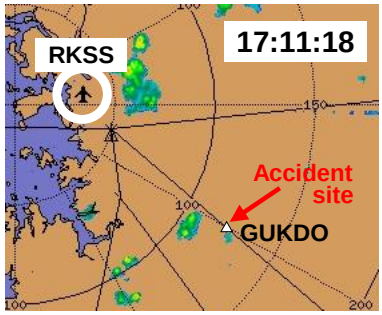


Figure 4　Radar Observation Data

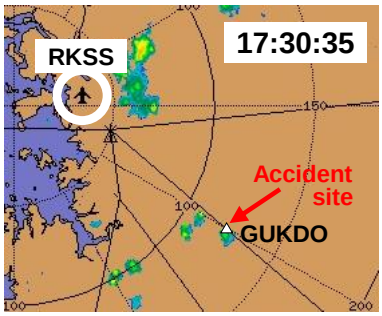


Condition before reporting by the operation support staff at RKSS

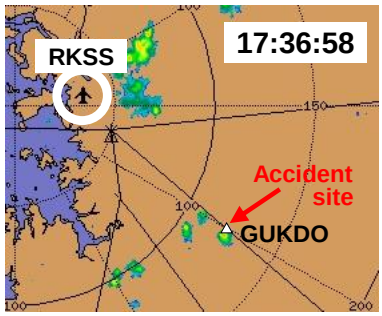


Echo developed around GUKDO (22 minutes before the accident)

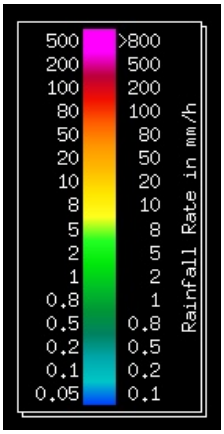
Incheon Terminal Doppler Weather Radar



Echo grew up around GUKDO (2.5 minutes before the accident)



Echo grew up around GUKDO (4 minutes after the accident)



Refresh rate: 6 to 7 minutes

- Time : Korean Standard Time (same as JST)
- RKSS : Gimpo International Airport
- Accident site : 123 km southeast of Incheon TDWR