

AA2006-5

AIRCRAFT ACCIDENT INVESTIGATION REPORT

ALL NIPPON AIRWAYS FLIGHT 589
BOEING 767-300,JA8669
APPROXIMATELY 18 KILOMETERS NORTH OF MATSUYAMA AIRPORT,
AT AN ALTITUDE OF APPROXIMATELY 800 METERS
JANUARY 22, 2006

November 24, 2006

Aircraft and Railway Accidents Investigation Commission
Ministry of Land, Infrastructure and Transport

The investigation for this report was conducted by Aircraft and Railway Accidents Investigation Commission, ARAIC, about the aircraft accident of All Nippon Airways Flight 589 Boeing 767-300,JA8669 in accordance with Aircraft and Railway Accidents Investigation Commission Establishment Law and Annex 13 to the Convention of International Civil Aviation for the purpose of determining cause of the aircraft accident and contributing to the prevention of accidents and not for the purpose of blaming responsibility of the accident.

This English version report has been published and translated by ARAIC to make its reading easier for English speaking people those who are not familiar with Japanese. Although efforts are made to translate as accurate as possible, only the Japanese version is authentic. If there is difference in meaning of the texts between the Japanese version and the English version, texts in the Japanese version are correct.

Junzo Sato,
Chairman,
Aircraft and Railway Accidents Investigation Commission

AIRCRAFT ACCIDENT INVESTIGATION REPORT

ALL NIPPON AIRWAYS, CO., LTD.
BOEING 767-300, JA8669
APPROXIMATELY 18 KILOMETERS NORTH OF MATSUYAMA AIRPORT,
AT AN ALTITUDE OF APPROXIMATELY 800 METERS
JANUARY 22, 2006, APPROXIMATELY 13:54 JST

September, 27, 2006

Decision by the Aircraft and Railway Accidents Investigation Commission

(Air Sub-committee Meeting)

Chairman	Junzou Sato
Member	Yukio Kusuki
Member	Susumu Kato
Member	Noboru Toyooka
Member	Yukiko Kakimoto
Member	Akiko Matsuo

1. PROCESS AND PROGRESS OF AIRCRAFT ACCIDENT INVESTIGATION

1.1 Summary of the Accident

On January 22, 2006 (Sunday), All Nippon Airways Flight 589, a Boeing 767-300, JA 8669, took off from Tokyo International Airport at 12:40 Japanese Standard Time(JST) on a regularly scheduled service.(All the times written below indicate JSTs) During the descent to Matsuyama Airport, the aircraft experienced a shake at approximately 13:54 , which caused two cabin attendants in the cabin aft galley to fall down on the floor. The aircraft landed at Matsuyama Airport at 14:00.

There were 287 people on board, consisting of the captain, seven other crewmembers, and 279 passengers. Among the crewmembers, one crewmember was seriously injured and one was slightly injured.

The aircraft was not damaged.

1.2 Outline of the Accident Investigation

1.2.1 Investigation Organization

On January 23, 2006, the Aircraft and Railway Accidents Investigation Commission assigned an investigator-in-charge and two investigators to the accident.

1.2.2 Accredited Representative Participating in the Investigation

An accredited representative of the United States, the state of design and manufacture of the aircraft involved in the accident, participated in the investigation.

1.2.3 Implementation of Investigation

January 24, 2006	Interviews, and investigation of aircraft
January 26, 2006	Interviews
January 26 – February 10, 2006	Analysis of data recorded by digital flight data recorder
February 2 – 14, 2006	Interviews

1.2.4 Interviews with Personnel of Relevant Organizations Personnel

Interviews were conducted with personnel of the organizations relevant to the cause of the accident.

1.2.5 Comment from the State of Design and Manufacture

Comment will be invited from the state of design and manufacture of the aircraft involved in the accident.

2. FACTUAL INFORMATION

2.1 History of the Flight

On January 22, 2006 (Sunday), a Boeing 767-300, JA 8669, (hereafter called “the aircraft”) operated by All Nippon Airways Co., Ltd. (hereafter called “the company”) took off from Tokyo International Airport at 12:40 as Flight 589 on the company’s regularly scheduled service. During its descent to Matsuyama Airport, it experienced a shake. The aircraft continued the descent and landed at Matsuyama Airport at 14:00 .

The aircraft’s flight plan reported to the Tokyo Airport Office was as outlined below.

Flight rules: Instrument flight rules (IFR)

Departure aerodrome: Tokyo International Airport

Estimated off-block time: 12:20

Cruising speed: 478 knots

Cruising altitude: FL380

Route: Nagoya VOR/DME – V28 (airway) – BAMBO (reporting point) – KINOE (reporting point)

Destination aerodrome: Matsuyama Airport

Total estimated elapsed time (EET): 1 hour and 31 minutes

Endurance: 2 hours and 56 minutes

Number of people on board: 287

There were 287 people on board the aircraft, consisting of the captain, seven other crewmembers, and 279 passengers (including four infants). In the cockpit, the first officer, who was undergoing upgrade training for qualification as captain, sat in the left seat as the pilot flying (hereafter called “PF”; primarily responsible for aircraft maneuvering) while the captain sat in the right seat as the pilot not flying (hereafter called “PNF”; primarily responsible for non-maneuvering tasks).

The flight history of the aircraft determined from the records of the digital flight data recorder (hereafter called “DFDR”) and the statements from the flight crewmembers, the chief purser (hereafter called “CP”) and cabin attendants (hereafter called “CAs”) is as outlined below.

2.1.1 History of the Flight According to DFDR Records

According to the DFDR records, the aircraft was descending when it reached an altitude of 10,012 feet at 13:48:21 .

The aircraft started shaking when it passed an altitude of 7,848 feet at 13:49:38. Shaking of the same magnitude continued until 13:52:55 and then weakened slightly. At 13:53:23 , the magnitude of the shaking started increasing again, with the minimum vertical acceleration recorded at 13:53:33 being 0.654G and the maximum vertical acceleration

recorded at 13:53:34 being 1.57G. The shaking then continued, without showing any salient peaks.

The aircraft made a left turn at about 13:53:25 to change its heading southward; the bank angle was 26.7° at 13:53:34 and reached a maximum of 28.1° at 13:53:39.

The autopilot remained engaged until 13:57:46, at which time the aircraft was at an altitude of 1,496 feet.

(See Figure 4.)

2.1.2 Flight Crew's Statements about History of the Flight

(1) Captain

On the day of the accident, I was to sit in the right seat as PNF to do tasks for upgrade training of the first officer for qualification as captain.

I arrived at the office ahead of schedule. The first officer (the trainee) was already in the office, so I started the training, beginning with the first item of the captain's preflight checks, at about 11:10. The meeting before a departure typically starts one hour before the departure, so the start of the meeting on this occasion was relatively early.

Based on my own judgment and the briefing given by the first officer, I did not believe there were any special weather conditions that might hinder the flight. Before the takeoff, I was informed that the atmosphere was calm at altitudes up to 20,000 feet in the destination airport area. During the climb phase, the aircraft experienced shaking of an uncomfortable level of which I had been informed beforehand.

The aircraft made a descent in the vicinity of Otsu from FL380 to FL180. The atmosphere was stable there, and I thought that the information indicating a calm atmosphere at altitudes up to 20,000 feet (the information I had received before takeoff) was credible.

After the descent to FL180, the CP informed me of completion of the cabin service. At this time, I told the CP that the time of arrival at Matsuyama would be earlier than scheduled and that, based on the Matsuyama weather report and my own evaluation, I did not expect any shaking.

In the course of the subsequent descent to an altitude of 10,000 feet in accordance with an instruction from Fukuoka Control, the control was transferred to the Iwakuni Approach, which indicated the heading to take and instructed the aircraft to descend to an altitude of 2,600 feet; the aircraft continued to descend accordingly.

The aircraft shook at about the time when it passed 8,000 feet. The magnitude of the shake seemed to be of a level of "light minus"(see Attachment). It included small pauses, and I felt it as a "pulsating" shake. According to my recollection, the aircraft started shaking at an altitude of approximately 8,000 feet, winds were stronger at lower altitudes and the aircraft thus shook twice or three times there. I think the shake was most intense at an altitude of

about 3,000 feet or 2,600 feet.

(2) First officer

I went to the office early since an on-the-job-training flight for my qualification as captain was scheduled that day and it had snowed on the previous day.

I analyzed the weather based on various weather reports and started ahead of schedule the briefing to the captain on the captain's preflight check items. I saw that the weather in the western part of Japan would not hinder the flight. Notably, however, I predicted that shaking would occur because of the jet stream and that it would occur here and there during both the climb phase and the descent phase. I briefed the captain to the effect that there were no weather conditions that would obstruct the flight at the destination and alternate airports.

I continued my briefing using the Pilot Oriented Briefing System (POBS)*1. The cruising altitude in the POBS flight plan was FL400, but I changed it to FL380 in consideration of the predicted shaking. I went to the aircraft after confirming that there were no problems in other respects concerning the weather.

The CAs were to arrive at the airport on an ANA flight from Fukuoka, but the arrival was delayed. I briefed the CAs via the passenger address system so they could hear it while doing their cabin service duties. I did this because the CAs, having flown from Fukuoka, would know the weather conditions along the route and the captain advised me to do so. The briefing was as follows: "Weather conditions will be mainly good while we are flying en-route at FL380, but you must be adequately careful when doing cabin service because the aircraft may shake in some places. The climb and descent phases will be accompanied by shakes resulting from variations in wind. During the climb phase, the seatbelt sign will be kept on for at least 12–13 minutes." I intended to decide the seatbelt sign timing during the descent phase upon hearing the local information over the company radio.

The aircraft flew en-route against a strong headwind of approximately 200 knots. Being informed of calm air currents at altitudes up to 20,000 feet in the central and western parts of Japan via the company radio from Chubu International Airport, I descended to fly at a cruising altitude of FL180.

When the aircraft approached Matsuyama Airport, I obtained the weather information for the Matsuyama area and the Automatic Terminal Information Service (ATIS) information for 13:00 through the Aircraft Communication Addressing and Reporting System (ACARS) before making a descent from FL180. There were no weather problems, and a visual approach to Runway 32 was specified for the aircraft. Considering also the in-house report indicating calm air currents at altitudes up to 20,000 feet, I determined that it was safe to

*1 POBS is a personal-computer-based system by means of which the dispatcher creates a flight plan before a flight by entering all necessary data. The captain uses the system to approve the flight plan after checking its contents.

carry out the in-descent safety check (the safety check performed by CAs after the illumination of the seatbelt sign in preparation for landing). Upon receiving a report of termination of the cabin service while the aircraft was cruising at FL180, I asked the captain to announce the weather information obtained from Matsuyama over the passenger address system.

The aircraft then descended following a descent instruction from the control tower. There were scattered clouds above the land in the Shikoku and Chugoku areas, but there were almost no clouds on the aircraft's flying route. When the aircraft passed 10,000 feet during the descent, I turned on the seatbelt sign and simultaneously rang the four-time chime (an instruction for doing cabin safety check; hereafter called "4-chime") after determining that there were no problems in the weather conditions. The air currents were calm at this time. The navigation system indicated 11 minutes remaining before arrival at Matsuyama Airport.

Small and thin patches of cloud were encountered during the descent from 10,000 feet, so I avoided them by changing the rate of descent. The aircraft shook slightly beginning at about 8,000 feet. The magnitude as felt by me was light, and I judged that it was safe to perform the safety checks. A control instruction to descend to 2,600 feet was then given to the aircraft. I thought that the shaking lasted until the aircraft had descended to 5,000 or 6,000 feet. Although there was a slight mist, the runway was visible enough for me to have it in view when it was approximately 10 nautical miles ahead.

The Route Manual indicates for a visual approach to Matsuyama Airport that an aircraft should fly the central path between Nakajima Island and Gogoshima Island and head to the downwind leg if it is to land on Runway 32. In accordance with the Route Manual, the aircraft flew the central path between Nakajima Island and Gogoshima Island at an altitude of approximately 2,600 feet. A sudden shake of light magnitude occurred while the aircraft was making a turn in the vicinity of Nakajima Island. The shake was temporary, lasting for a very short period. There were no shakes after the one that had suddenly occurred near Nakajima Island. Since the aircraft was turning, the shake was a lateral one that felt as though the aircraft was being blown by a wind.

The aircraft then landed according to the normal procedure. The captain and I were to accomplish our duties in the same aircraft on the scheduled return flight to Tokyo, and the CAs were to deplane and stay the night in Matsuyama. Inside the aircraft before descending from it, the captain and I received a report from the CP telling us that no abnormalities had been found. It seems to me that the CP had not yet heard that CAs had fallen down in the aft part of the cabin.

The captain and I then went to the station for debriefing on the weather conditions during the en-route phase. I said that the experienced shaking contradicted the preflight information (which indicated calm air at altitudes up to 20,000 feet). I said that the shakes occurred at altitudes not exceeding 20,000 feet and specifically that the aircraft shook from about 8,000 feet to about 5,000 or 6,000 feet. However, I did not mention the shake that

occurred in the vicinity of Nakajima Island because I considered it a temporary shake that just happened to occur.

When the captain and I returned to the aircraft later, the CP informed us that the CA responsible for the R2 area*² (hereafter called “R2 area CA”) in the aft part of the cabin had fallen on her bottom. The time when the CA fell down was about six minutes after the 4-chime rang; I remembered that it coincided with the time when I turned the aircraft’s heading toward the downwind leg at a point 10 nautical miles from Matsuyama Airport while having the runway in view and the aircraft shook during the turn. The wind at that time, as I remembers, was from about 270–280° at about 20–30 knots.

(3) CP (responsible for L1 area)

I and the CAs returned to Tokyo as passengers on the company’s flight from Fukuoka. I told the PF that we experienced light shaking during the flight from Fukuoka. Since only a short time was left before the departure, the PF gave a briefing to the CAs over the passenger address system. In the briefing, the PF said that shaking was expected during the climb phase.

The seats were fully occupied, and the CP and CAs were able to perform the cabin service normally during the cruising period.

Following the information from the PF that the aircraft would descend to FL180 due to a strong headwind, I had the CAs stow the carts. I was told that the air from FL180 downward was calm and that the cabin service could, therefore, be performed with no hurry.

Cabin service is not permitted after ringing of the 4-chime. I understands that the 4-chime usually rings 10 minutes before landing. After the ringing of the 4-chime, the CAs refuse orders for beverages from passengers. I performed a safety check as usual and confirmed that the galley locks were in the locked positions by looking and pointing at them. At this time, I felt a pulsating shake, which made me expect a larger shake; soon there was a shake large enough to make me decide to sit rather than remain standing. Immediately after I sat on the seat, a shake occurred with a magnitude that made me feel relieved that I had sat down.

As one of the CP’s duties, I had to confirm satisfactory completion of the safety checks by both the CAs responsible for the LC and L2 areas. When I sat in my seat, I received a ‘satisfactory completion’ signal from the CA responsible for the LC area, who was also seated. I had not yet been given a signal by the CA responsible for the L2 area (hereafter called “L2 area CA”). Later, three to four minutes before the gear was put down, the L2 area CA gave me a ‘satisfactory completion’ signal.

After the landing, I made a report to the captain, saying, “There are no abnormalities in the cabin.” The captain and first officer then deplaned. After that, I and the CAs also

*² Each CA is responsible for a specified cabin area. These areas are L1 (left forward), R1 (right forward), LC (left center), RC (right center), L2 (left aft), and R2 (right aft).

deplaned. On arrival at the station control office, the R2 area CA informed me that she had fallen on her bottom at the end of her pre-landing safety check work. I, judging it to be advisable to report the fact to the captain, informed the captain, who was back in the aircraft for the next departure.

(4) R2 area CA

The preflight briefing was held over the passenger address system, and it indicated that shakes were expected during both the climb and descent phases of the flight. I consequently thought shaking would probably occur.

I was in the L1 area when the 4-chime rang before landing, so I returned to my assigned area to start the safety checks. After completing the usual checks, I performed a double check together with the L2 area CA. We then disposed of beverages on the cart. At the moment when we were about to return to our assigned CA seats, a large shake occurred once. Both I and the L2 area CA grabbed the galley handle and sat on the floor in a single motion. Only two or three seconds after the first shake (before the R2 area CA could stand up), there was another large shake that made me feel as though I were lifted in the left forward direction. The shake force was so strong that I lost my grip on the handle and was thrown upward such that I fell on the left side of my lumbar area. I could not raise myself up for 10 seconds after falling down. I then returned to my CA seat.

The shake was unusual in that it involved an upward push and a left forward twist.

I was in charge of greeting the deplaning passengers that day, so I finished this task before informing the CP that I had fallen down on my bottom.

I stayed that night in Matsuyama and was scheduled to be on duty the next day. Concerned about the possibility of lumbar pain, I went to a hospital for a doctor's checkup after telling the CP of my intention to do so. The doctor diagnosed the injury as a lateral promontory bone fracture of the first lumbar vertebra. I told this result to the CP, adding that I would be able to fulfill my duties if necessary since I did not feel any pain.

I went back to Tokyo the next day without assuming my duty and then visited a hospital to obtain a medical certificate.

(5) L2 area CA

Being in charge of announcements, I made an announcement from the L2 area CA station upon ringing of the 4-chime. The aircraft shook while I was doing safety checks, so I wished to complete the job quickly. While I was disposing of beverages in the galley after completing the safety checks, a sudden downward shake occurred, causing me and the R2 area CA to grab the galley handle. While both CAs were in a squat, a sideways shake occurred, causing the R2 area CA to fall down and roll half a turn. I was also swung, but since I kept hold of the handle, the shake force twisted my body, onto which fell the R2 area CA's upper body. It seemed to me that the R2 area CA was first swung toward the R2 side and then fell down toward the L2 side.

Anticipating continued shakes, I immediately sat in a nearby seat, but the R2 area CA appeared unable to get up right away. When both of us had returned to our seats, I confirmed that there was no problem in my area and then reported to the CP that the preparation of the cabin was complete.

I felt discomfort after completing my work on the following day, so I went to a hospital, where my condition was diagnosed as bruising.

This accident occurred at about 13:54, at a point approximately 18 kilometers north of Matsuyama Airport at an altitude of approximately 800 meters (approximately 2,700 feet).

(See Figures 1, 3 and 4.)

2.2 The Dead, Missing, and Injured

The one CA responsible for the R2 area was seriously injured, and the one CA responsible for the L2 area was slightly injured.

2.3 Pilot Information

(1)	Captain	Male, 57 years old	
	Airline transport pilot certificate (Airplane)		October 13, 1978
	Type rating for Boeing 767		August 22, 1988
	1st class aviation medical certificate		
	Validity		Until March 27, 2006
	Total flight time		17,278 hrs and 34 min
	Flight time in the last 30 days		46 hrs and 56 min
	Flight time on the aircraft type		4,986 hrs and 20 min
	Flight time in the last 30 days		46 hrs and 56 min
(2)	First officer	Male, 39 years old	
	Airline transport pilot certificate (Airplane)		February 21, 2003
	Type rating for Boeing 767		February 14, 1995
	1st class aviation medical certificate		
	Validity		Until January 31, 2006
	Total flight time		6,446 hrs and 54 min
	Flight time in the last 30 days		55 hrs and 29 min
	Flight time on the aircraft type		3,113 hrs and 24 min
	Flight time in the last 30 days		55 hrs and 29 min

2.4 Aircraft Information

2.4.1 Aircraft

Type	Boeing 767-300
Aircraft serial number	27444

Date of manufacture	February 1, 1995
Certificate of airworthiness	99-059
Validity	Period during which the Maintenance Manual (All Nippon Airways Co., Ltd.) has been effective since March 12, 1999
Total flight hours (See Figure 2.)	24,530 hrs and 52 min

2.4.2 Weight and Balance

At the time of the accident, the calculated weight and center of gravity of the aircraft were 250,300 pounds and 20.9 percent mean aerodynamic center (MAC), respectively. It is estimated that both of them were within the permissible limits (288,700 pounds in maximum takeoff weight and 12.0–33.1 percent MAC) for the weight at the time of the accident.

2.5 Information on Digital Flight Data Recorder and Cockpit Voice Recorder

The aircraft was equipped with a digital flight data recorder produced by the US manufacturer L-3 Communications Corp. (P/N 10077A500-803; hereafter called “DFDR”) and with a cockpit voice recorder produced by the US manufacturer LAS (P/N 2100-1020-00; hereafter called “CVR”).

The DFDR retained records from the time when the aircraft took off at Tokyo International Airport to the time when it landed at Matsuyama Airport. The portion of the CVR records around the period of occurrence of the accident was overwritten and erased because the aircraft was operated for the return service to Tokyo before the conditions of the injured CAs were diagnosed.

2.6 Meteorological Information

2.6.1 Synoptic Weather Report by Matsuyama Observatory at 10:33 (Extract)

A winter pressure pattern is prevailing in Ehime Prefecture, and the weather is generally fair.

The winter pressure pattern will remain dominant today, and clouds are likely to form under the effect of cold air, causing some areas to have snow in the evening and later.

2.6.2 Weather Observation Data of Matsuyama Airport

10:00	Direction of wind ... VRB; Velocity of wind ... 2 knots (Only wind data are shown below for times through 13:00.)
11:00	Direction of wind ... 200°; Velocity of wind ... 6 knots
12:00	Direction of wind ... 240°; Velocity of wind ... 12 knots
13:00	Direction of wind ... 250°; Velocity of wind ... 17 knots
14:00	Direction of wind ... 250°; Velocity of wind ... 17 knots; Prevailing

visibility ... 35 kilometers; Clouds: amount ... 1/8; type ... cumulus; ceiling ... 2,500 feet; Altimeter setting (QNH) ... 29.92 inches Hg

2.6.3 Wind Data Recorded by DFDR from Vicinity of Shake Occurrence Point to Downwind Leg

13: 53: 31 Altitude ... 2,744 feet; Direction of wind ... 280.5°; Velocity of wind ... 22.5 knots
13: 54: 31 Altitude ... 2,272 feet; Direction of wind ... 271.8°; Velocity of wind ... 16 knots
13: 55: 31 Altitude ... 1,908 feet; Direction of wind ... 257.3°; Velocity of wind ... 20 knots
13: 56: 31 Altitude ... 1,544 feet; Direction of wind ... 262.3°; Velocity of wind ... 18 knots
13: 57: 31 Altitude ... 1,468 feet; Direction of wind ... 246.4°; Velocity of wind ... 28.5 knots

2.6.4 The Matsuyama Airport aerodrome forecasts for short range flight (TAF-S (SHORT)) were as follows :

Forecast issued at 09:00

Present conditions at 09:00:

Direction of wind ... 120°; Velocity of wind ... 10 knots; Visibility ... 10 kilometers or more; Clouds: amount ... 1/8–2/8; ceiling ... 3,000 feet

Forecast for 09:00–18:00:

Winds will change gradually between 10:00 and 12:00, ending with 280° in direction and 15 knots in velocity.

Not continuously between 15:00 and 18:00, winds of 280° in direction and 18 knots in velocity with peak gusts at 28 knots will occur occasionally or frequently.

Forecast issued at 12:00

Present conditions at 12:00:

Direction of wind ... 280°; Velocity of wind ... 15 knots; Visibility ... 10 kilometers or more; Clouds: amount ... 1/8–2/8; ceiling ... 3,000 feet; amount ... 3/8–4/8; ceiling ... 4,000 feet

Forecast for 12:00–21:00:

Not continuously between 14:00 and 18:00, winds of 280° in direction and 16 knots in velocity with peak gusts at 26 knots will occur occasionally or frequently.

2.6.5 Surface Weather Map

The surface weather map for 09:00 on January 22, 2006 shows a typical winter

pressure pattern including high pressure centered around the upper reaches of the River Amur and low pressure that caused snow on the previous day in the Kanto region and was now present over the sea to the east of Japan. The low pressure was traveling fast, resulting in widely spaced isobars near the Shikoku area and consequent surface winds not higher than 10 knots in velocity.

(See Figure 5.)

2.7 Medical and Pathological Information

The injured R2 area CA underwent a medical examination at a hospital in Matsuyama after deplaning. Her injury was diagnosed as a fracture of the lateral promontory of a lumbar vertebra. She had another medical examination the next day in Tokyo and then submitted a medical certificate to the company.

The L2 area CA, who was in the same place as the R2 area CA at the time of the accident and later went to a hospital with discomfort in her lumbar area, had her case diagnosed as a bruise in her lumbar area.

2.8 Other Relevant Information

2.8.1 The company's in-house Route Manual contains the following information about landing approaches to Matsuyama Airport (visual approaches from the north of the airport). The first officer flew the aircraft in conformity with this information.

MATSUYAMA AIRPORT BRIEFING 2

LOCAL PROCEDURES

1. ARRIVAL PHASE

It is recommended that an aircraft making a visual approach to RWY14 flies the northwesterly side of Gogoshima Island and intercepts the final approach course at around 3–5 nautical miles on final for the purpose of avoiding conflicts with other aircraft flying under visual flight rules and for protection of the environment. This recommendation shall also be applied to a visual approach to RWY32.

2.8.2 The company's in-house Cabin Operations Manual contains the following information about the preflight safety checks.

Cabin Operations Manual

Chapter 4 Daily Safety-Related Tasks

(14) Preventive measures to assure cabin safety

(Skipped)

■Measures to prevent accidents in cabin in event of turbulence

(Skipped)

- (7) The “10-minute before landing” sign shall also be interpreted as permission given by the captain for the pre-landing safety checks. If the chief purser judges performing the safety checks to be impracticable due to the cabin situation at the time when the safety check permission is given, he/she must immediately inform the captain. The cabin check items must be made known to the passengers verbally over the passenger address system or directly.

(Skipped)

- (19) Safety checks

The cabin attendants perform a check for each of the items indicated below upon illumination of the seatbelt sign and no smoking sign, and they report the results through the pre-established information path.

■Timing, sign, and items for checking

Timing	Sign	Check item
Pre-landing safety check	(No smoking sign) 4-chime ringing Seatbelt sign	Cabin (no smoking, seatbelts, carry-on baggage, seatbacks, seat tables), lavatories, galley, crew rest area / crew bunks, others I and II

(In the above table, “others I and II” describes the details of each check item and the check procedure for it.) Information on dealing with unforeseen turbulence is given as follows:

Chapter 5 Dealing with Irregular Events

5-2 Safety

- (13) Encounters with Turbulence

(Skipped)

■Encounter with unexpected turbulence (turbulence about which the crew has not been informed)

The cabin attendants must each get down low, keeping their centers of gravity low enough to prevent themselves from falling down. Staying low, they must immediately move to any unoccupied seats. If they cannot do so (for example, when there are no unoccupied seats), they must support themselves by holding the galley handle or by grasping armrests from below.

2.8.3 Information on Weather at Matsuyama Airport Obtained by the Aircraft by Means of ACARS during Its Flight

Weather reports (RJOM AIRPORT REPORTs) for Matsuyama Airport were prepared by the company’s operation support staff stationed at the airport in the form of electronic data. As mentioned in section 2.1 of this report, the captain and first officer obtained the weather report through the ACARS before the flight and during the flight phases until landing. The

reports included information indicating that the air was calm at altitudes up to 20,000 feet. This information remained unchanged in four reports that were issued at 10:28, 11:10, 11:30, and 12:50, respectively (a period of about two and a half hours), but it was changed in accordance with information from the aircraft after the aircraft landed.

Weather reports are updated in accordance with weather information on the relevant airport and in accordance with information reported by the company's relevant flights. In addition, they are updated to reflect sudden or important meteorological changes (for example, movements of fronts) even in the absence of information from the company's flights.

3. ANALYSIS

3.1 The captain and the first officer of the aircraft both possessed proper airman competency certification and valid aviation medical certificates.

3.2 The aircraft had been certified for airworthiness and had been maintained and inspected in accordance with the program specified by the company.

3.3 Weather Analysis

(1) As described in section 2.1.2 of this report, there were no clouds on the flight route of the aircraft. It is thus estimated that the turbulence the aircraft encountered was clear air turbulence. Judging from the pressure pattern map for the day of the accident, there would not have been any anomalous meteorological phenomena at low altitudes.

(2) The surface weather map for 09:00 on the day of the accident shows a winter pressure pattern, but the surface winds in and around the Shikoku area were weak and their velocities at Matsuyama Airport were no higher than 10 knots. However, as indicated in section 2.6.2 of this report, the conditions reported at 12:00 at Matsuyama Airport show that a westerly wind was prevailing and that it became stronger later. It is thus estimated that a westerly wind typical of the winter pressure pattern had increased in strength.

Since the aircraft encountered shakes at altitudes of approximately 8,000 feet and lower during its descent phase, it seems likely that the middle to low layer atmosphere, which had so far been calm, became turbulent because of the increase in strength of the westerly wind.

3.4 Safety Checks

It is estimated that the PF saw no problem in giving the safety check instruction because no shaking was experienced at an altitude of around 10,000 feet, the portion of the route to Matsuyama Airport was clear of clouds, and he was not informed of any shake in the low layer atmosphere.

It is considered likely that the two CAs who were injured did not judge the shaking they experienced during the safety checks to be of a type that required them to stop their work.

It is estimated that the two injured CAs took actions conforming to the information shown in section 2.8.2 of this report when they encountered unexpected, sudden shaking in the aft galley.

3.5 Shake at the Time of Occurrence of the Accident

It is estimated that the accident occurred when the aircraft was making a left turn at

a bank angle of 27° during the descent phase as described in section 2.1.1 of this report.

Since the DFDR recorded the peak G values for both lateral and vertical accelerations simultaneously, it is estimated that the aircraft encountered a large shake while it was making a turn. It is considered likely that combination of vertical and lateral movements manifested itself as the shake in the aircraft and that the resulting forces were so strong that one of the two CAs in the aft area lost her grip on the galley handle.

Also, it appears possible that a large movement compared with usual ones in the rudder position that took place almost simultaneously with the recording of the peak G values contributed to the shake.

According to the DFDR records, the autopilot of the aircraft was engaged at the time of the accident. It is therefore estimated that the PF did not contribute to the rudder and elevator movements.

3.6 Prediction of Turbulence

The weather reports for the Matsuyama Airport area that the captain and PF obtained before and during the flight indicated calm air at altitudes up to 20,000 feet. However, it is estimated that the captain should have been able to recognize a change from the reported condition (calm air at altitudes up to 20,000 feet) because a winter pressure pattern was prevailing on the day of the accident, he was informed of a temporary increase in wind velocity by the aerodrome weather report from Matsuyama Airport, and the aircraft experienced a light level shake during the descent phase.

It is considered possible that the captain could, considering that relevant past accident cases showed that the aftmost part of the fuselage would shake most greatly, have given advance warning to the CAs before turning the aircraft or otherwise largely changing its position while shaking was taking place.

3.7 About Weather Reports for Matsuyama Airport

As mentioned in section 2.8.3 of this report, the weather report given to the aircraft via the ACARS through four updates over a period of about two and a half hours indicated that the air currents in altitudes up to 20,000 feet were calm.

At about the time of the accident, the weather information was updated with respect to the change in the airport surface winds but not with respect to the air condition at altitudes up to 20,000 feet, which continued to be reported as calm because of no occurrence of drastic meteorological change. But it appears possible that company's operation support staff would have been able to revise the "calm air in altitudes below 20,000 feet" information because, as shown in sections 2.6.2 and 2.6.3 of this report, the observation data indicated change in wind direction to westerly directions from the observation at 12:00 and also that surface gusts were expected from about 14:00.

4. PROBABLE CAUSE

It is estimated that the causal chain of this accident consisted of an encounter with local turbulence by the aircraft while the aircraft was making a turn during its descent phase and a consequent large shake of the aircraft, which caused the cabin attendants who were then working in the aircraft's aft galley to fall down and suffer injuries.

Figure 1 Estimated Flight Route

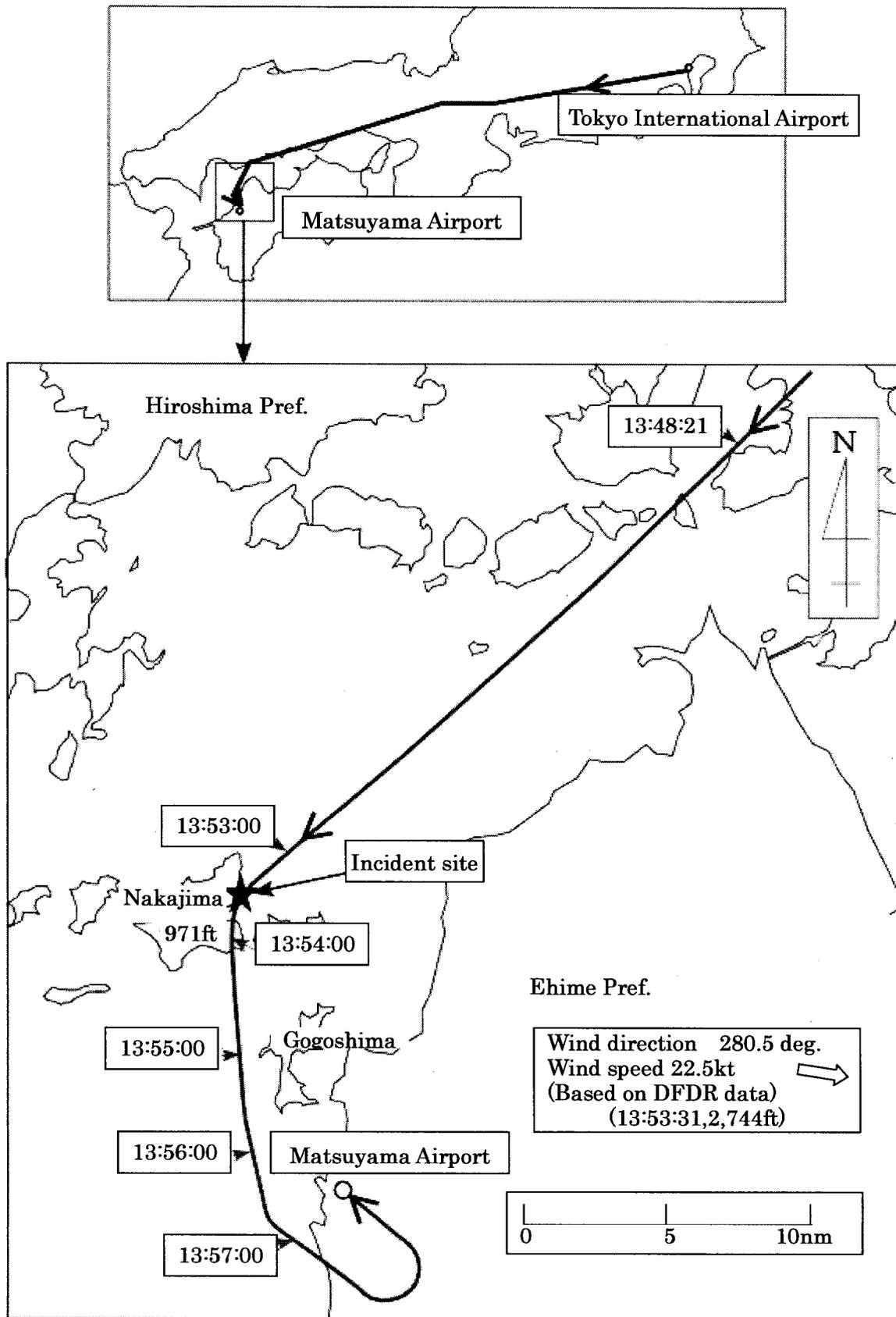


Figure 2 Three angle view of Boeing 767-300

Unit: m

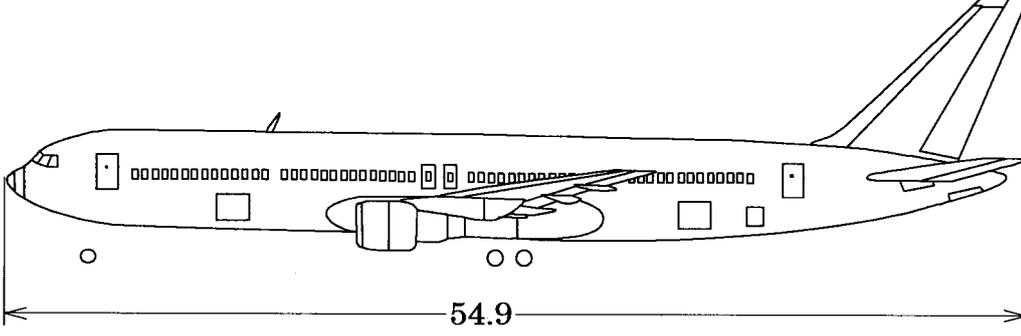
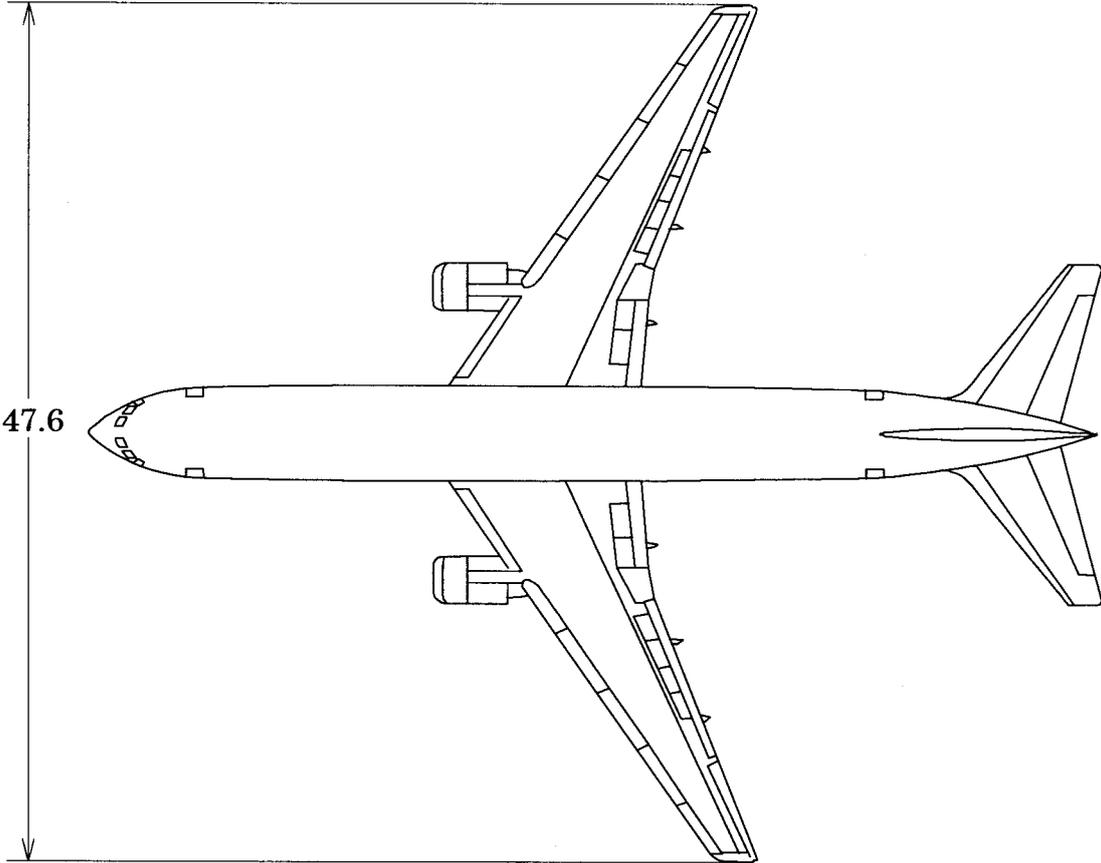
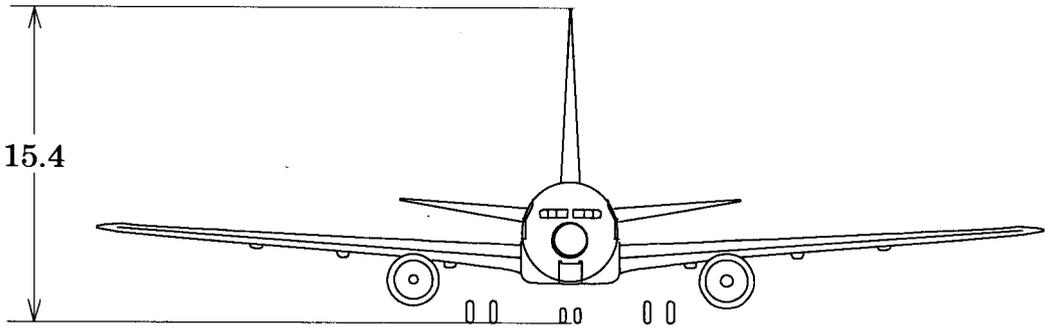


Figure 3 CA seating locations

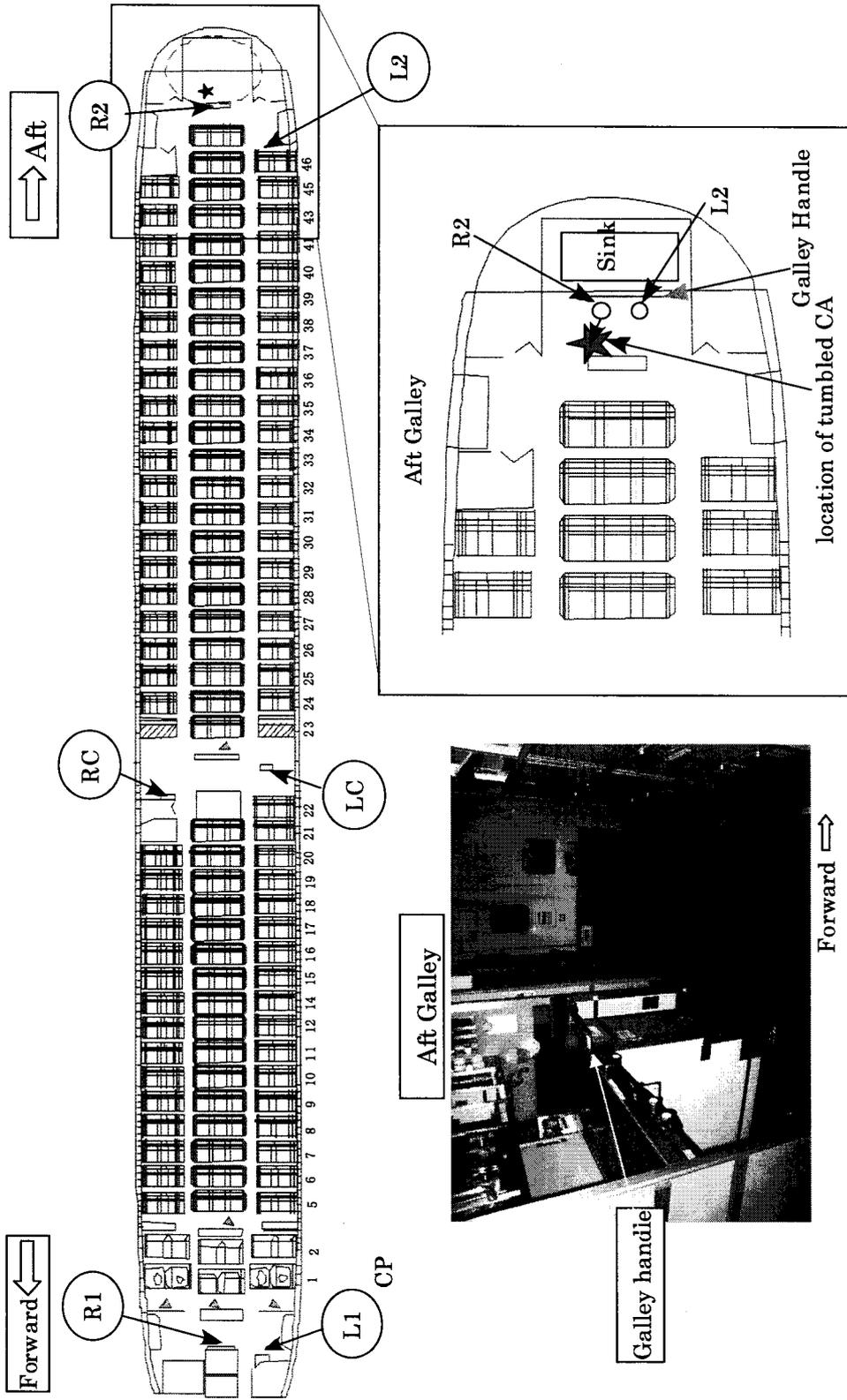


Figure 4 DFDR Recording

V/G Max
13:53:34

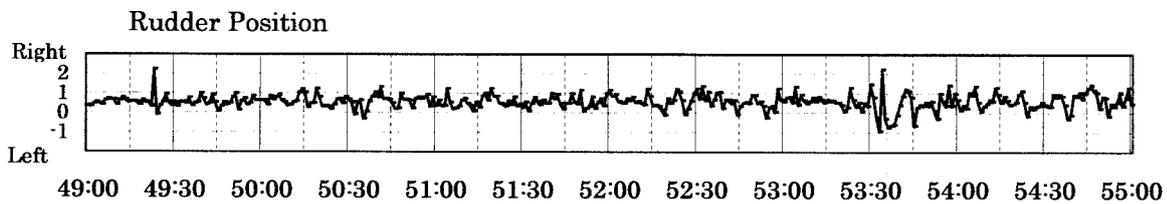
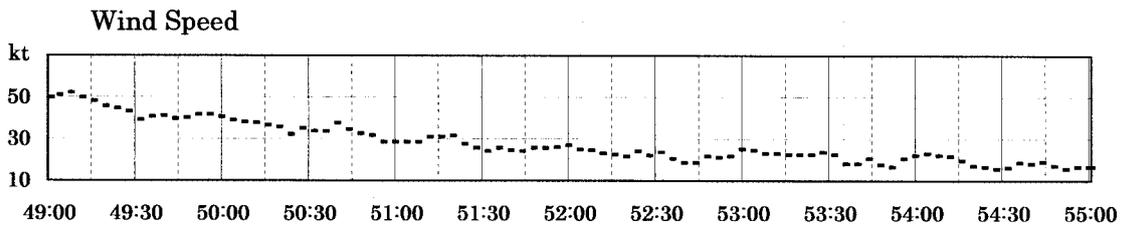
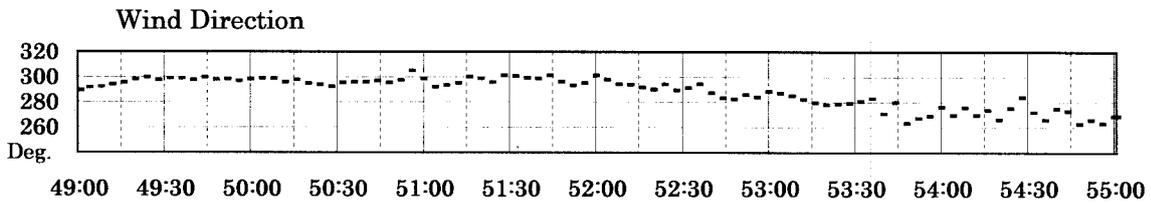
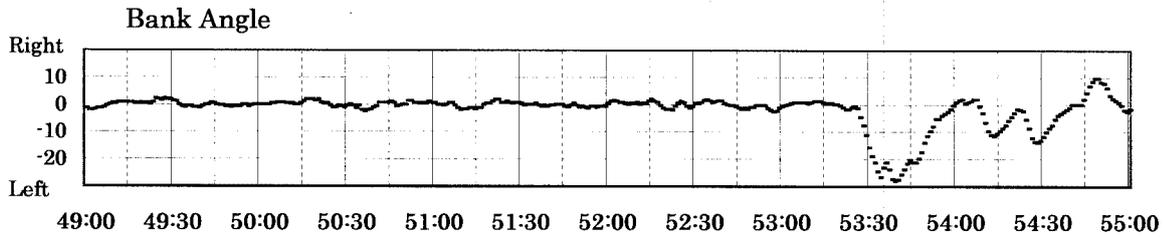
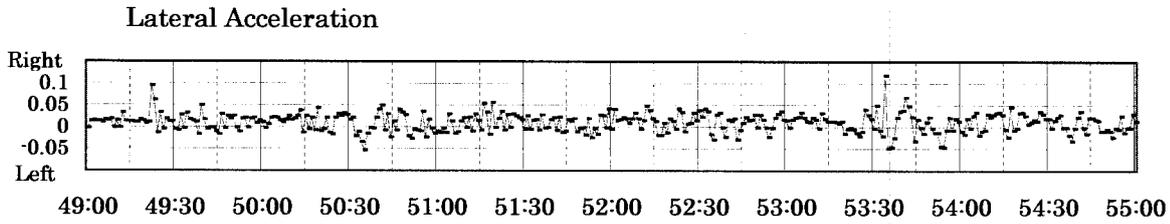
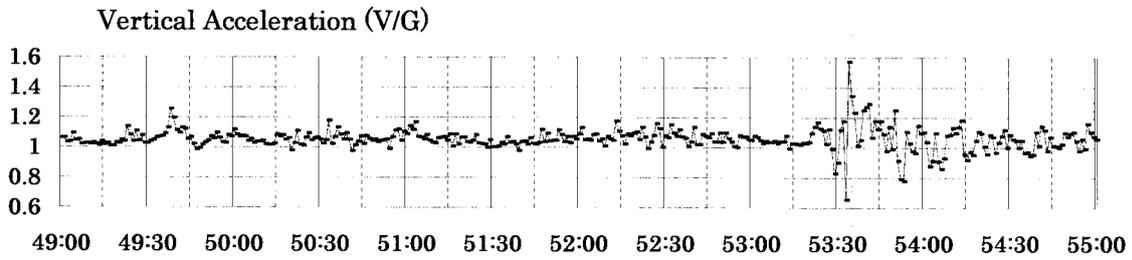
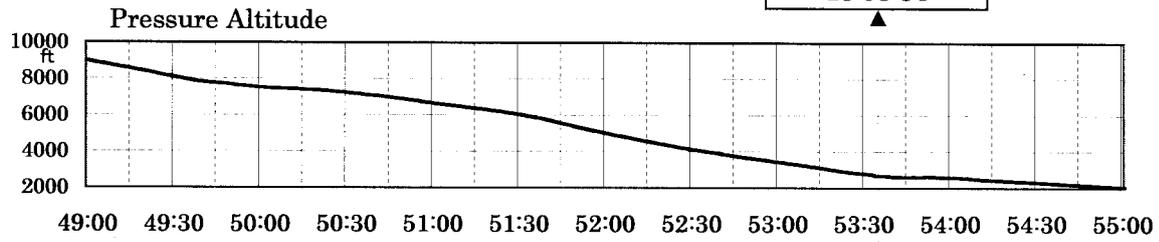
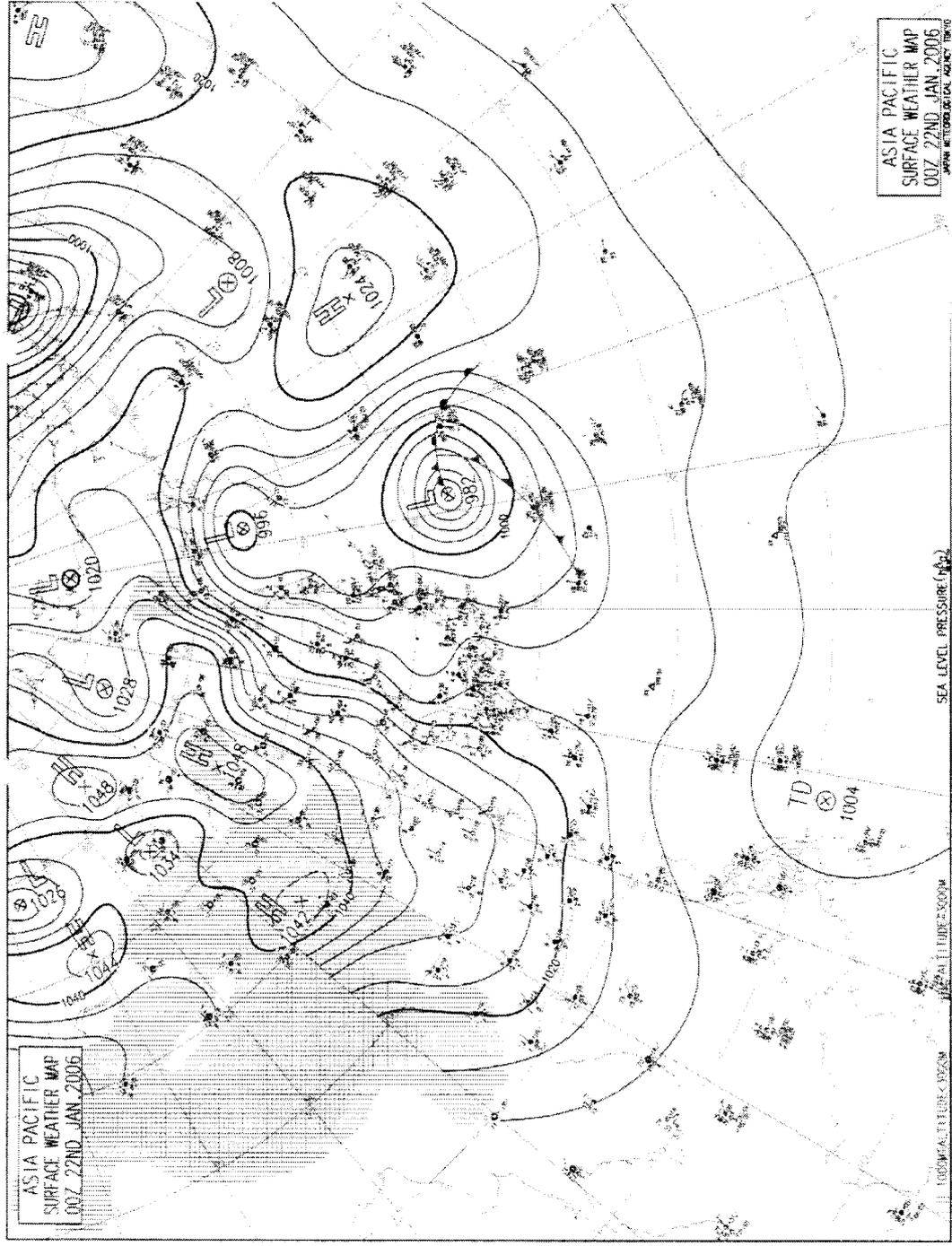


Figure 5 Asia surface weather map (09:00 January 22, 2006)



Turbulence Intensity Criteria

Condition	Code	Airplane Reaction	Cabin/Cockpit Reaction/Guidance	Cabin Service
LIGHT -	LGT -	Momentary, slight, erratic changes in altitude and/or attitude occur	Occupants may feel a slight strain against seat belts /shoulder harnesses. Loose objects may move slightly. No difficulty in walking and cabin services.	No difficulty
LIGHT	LGT			Available, need care for hot beverages.
LIGHT+	LGT+			Need extreme care, sometimes suspend service.
MODERATE	MOD	Changes in altitude/attitude occur, airspeed fluctuations occur, but the airplane remains in positive control.	Occupants feel definite strain against seat belts/shoulder harnesses. Unsecured objects move about. Difficult to walk.	Difficult to cabin service.
SEVERE	SEV	Large, abrupt changes in altitude/attitude occur. Usually large airspeed fluctuations occur. Airplane may be momentarily out of control.	Occupants forced violently against seat belts /shoulder harnesses. Unsecured objects tossed about. Walking impossible.	Cabin services impossible.
EXTREME	EXT	Airplane tossed violently about; practically impossible to control. May cause structural damage.		