

AI2008-01

**AIRCRAFT SERIOUS INCIDENT
INVESTIGATION REPORT**

KOREAN AIR LINES CO.,LTD.(REPUBLIC OF KOREA)

BOEING 737-900

REGISTRATION HL7724

AKITA AIRPORT, JAPAN

JANUARY 6, 2007 AT ABOUT 12:16 JST

November 28, 2008

Japan Transport Safety Board

The investigation for this report was conducted by Japan Transport Safety Board, JTSC, about the aircraft serious incident of KOREAN AIR LINES BOEING 737-900 registration HL7724 in accordance with Japan Transport Safety Board Establishment Law and Annex 13 to the Convention of International Civil Aviation for the purpose of determining cause of the aircraft serious incident 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 JTSC 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, text in the Japanese version is correct.

Norihiro Goto,
Chairman,
Japan Transport Safety Board

Abbreviated words

Abbreviated words used in this report are as follows:

ALB	: Approach Light Beacon
CRM	: Crew Resource Management
CVR	: Cockpit Voice Recorder
DFDR	: Digital Flight Data Recorder
EMC	: Error Management Course
F/D	: Flight Director
FMS	: Flight Management System
FOM	: Flight Operations Manual
FDGC	: Flight Director Guidance Cue
FPS	: Flight Path Symbol
GsRL	: Glide slope Reference Line
HUD	: Head Up Display
JCRM	: Joint CRM
LNAV	: Lateral Navigation
LOFT	: Line Oriented Flight Training
MDA	: Minimum Descent Altitude
NOTAM	: Notice To Air Men
PAPI	: Precision Approach Path Indicator
PFD	: Primary Flight Display
PIC	: Pilot In Command
PM	: Pilot Monitoring
STAR	: Standard Terminal Arrival Route
TAF	: Aerodrome (terminal or alternate) forecast
VDP	: Visual Descent Point
VNAV	: Vertical Navigation

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KOREAN AIR LINES CO., LTD. (REPUBLIC OF KOREA)

BOEING 737-900, HL7724

AKITA AIRPORT

AT ABOUT 12:16 JST, January 6, 2007

22 October, 2008

**Adopted by the Japan Transport Safety Board
(Aircraft Sub-committee Meeting)**

Chairman	Norihiro Goto
Member	Yukio Kusuki
Member	Shinsuke Endo
Member	Noboru Toyooka
Member	Yuki Shuto
Member	Akiko Matsuo

1. PROCESS AND PROGRESS OF THE SERIOUS INCIDENT INVESTIGATION

1.1 Summary of the Serious Incident

The event covered by this report falls under the category of “similarity”, as stipulated in Number 16 of Article 166-4 of the Civil Aeronautics Regulations of Japan, to the category of “Landing on a closed runway”, as stipulated in Number 2 of the same Article and, as such, is classified as an aircraft serious incident.

A Boeing 737-900, registered HL7724, which was operated by Korean Air Lines Co., Ltd. as scheduled flight 769, took off from Incheon International Airport (Seoul, the Republic of Korea) on January 6, 2007 (Saturday), and made an approach to Runway 10 of Akita Airport (Akita Japan), its destination, but landed on a parallel taxiway located south side of Runway 10 at about 12:16

Of the total of 133 persons on board, consisting of the captain, the first officer, seven other crewmembers and 124 passengers, no one was injured, and there was no damage to the aircraft.

1.2 Outline of the Serious Incident Investigation

1.2.1 Investigation Organization

On January 6, 2007, the Aircraft and Railway Accidents Investigation Commission appointed one investigator-in-charge and another investigator for this serious incident. In addition, on January 9 and on May 23, 2007, two more investigators were appointed.

1.2.2 Foreign Representative and Adviser

An accredited representative and an adviser of the Republic of Korea, the State of the Operator and the State of Registry, participated in the investigation.

Though the notification of this serious incident was made to the United States of America, the state of the design and manufacture of the aircraft, no representative was appointed.

1.2.3 Implementation of Investigation

January 6 and 7, 2007	Interviews and investigation of aircraft
January 9 to 17, 2007	Analysis of Flight Data Recorder and Cockpit Voice Recorder
January 16, 2007	Investigation of the head up display
March 22 and 23, 2007	Joint field investigation with the representative and the adviser of the Republic of Korea
April 4, 2007	Investigation of the Head Up Display

1.2.4 Interim Report

On July 25, 2008, Aircraft Railway Accident Investigation Commission submitted an interim report of investigation to the Minister of Land, Infrastructure, Transport and Tourism based on the fact finding up to date.

1.2.5 Comments from parties relevant to the cause of the serious incident

Comments were taken from parties relevant to the cause of the serious incident.

1.2.6 Comments from participating state

Comments were invited from the state participating in the investigation of the serious incident.

2. FACTUAL INFORMATION

2.1 History of the Flight

On January 6, 2007, at 10:35 (Local time in the Republic of Korea. It is the same as Japan Standard Time(JST),UTC+9h. Hereinafter all time is indicated in JST.), a Boeing 737-900 registered HL7724 (hereinafter referred to as “the Aircraft”),which was operated by Korean Air Lines Co., Ltd., (hereinafter referred to as “the Company”) took off from Incheon International Airport as the Company’s scheduled Flight 769.

The flight plan submitted to the Incheon International Airport Office(K-CASA) is outlined below.

Flight rules: Instrument flight rules

Departure aerodrome: Incheon International Airport

Estimated off-block time: 10:00

Cruising speed: 458kt

Cruising altitude: FL330

Route: ANYANG (VORTAC)-G597 (Airway)-LANAT (Reporting point)-Y51 (Airway)-SAMON (Reporting point)-Y14 (Airway)-NI (Sado NDB)-R347 (Airway)-GTC (Niigata VORTAC)-YAYOI (Reporting point)

Destination aerodrome: Akita Airport

Estimated flight time: 1h and 43min

Fuel load in terms of endurance : 4h and 33min

Number of persons on board: 133

In the cockpit of the Aircraft, the captain (Pilot in command :PIC) was taking the left seat as Pilot Flying (PF) (pilot primarily responsible for aircraft maneuvering tasks), with the first officer(FO) having taken the right seat as the Pilot Monitoring (PM) (pilot primarily responsible for non-maneuvering tasks).

Based on the records of the DFDR(Digital Flight Data Recorder) and the CVR(Cockpit Voice Recorder), and the statements by the operating crewmembers of the Aircraft and the air traffic controllers (hereinafter referred to as “controllers”) of the Akita Aerodrome Control Facility (hereinafter referred to as “Akita Tower”), history of the flight of the Aircraft is summarized as follows.

2.1.1 History of the Flight based on the DFDR and CVR Records

After taking off from Incheon Airport at 10:35, the Aircraft flew at FL 310, and conducted the landing briefing starting at around 11:50. During the briefing, the captain and the first officer had confirmed that no specific NOTAM was issued, and the Standard Instrument Arrival (STAR) and Instrument Approach Procedure of AKITA, VOR/DME No.1 RWY10 approach

(hereinafter referred to as “VOR No.1 approach”) for landing Runway 10 as well as the taxiway to use after landing and the route to the arrival spot.

Then, the Aircraft started to descend, at the altitude of approximately 9,300 ft, made contact with Akita Tower at about 12:06 (hereinafter in this section, time is indicated without “12 o'clock” for simplicity.), and reported that it was flying on the arrival route toward Runway 10. Akita Tower told the Aircraft to use Runway 10 and instructed to report its passing of OMONO point (the initial approach fix for VOR No.1 approach, hereinafter referred to as “OMONO”). The Aircraft continued descent further and reported its passing of OMONO at an altitude of approximately 3,200 ft at 11m57s, and received from Akita Tower: “Runway 10, cleared to land, wind 130 at 9, and it acknowledged this. (No subsequent communication was made between the Aircraft and Akita Tower until after landing of the Aircraft.) At 12m35s at an altitude of approximately 2,700 ft, the first officer called, “Runway in sight,” and at the same time the captain responded, “I have it in sight.” The distance of the Aircraft from the threshold of Runway 10 at that time was about 7.4 nm (hereinafter distance is measured from the threshold of Runway 10). After that, during the period from 14m09s, when the Aircraft was flying at an altitude of approximately 1,500 ft at a distance of approximately 3.6 nm, to the landing, the conversations in the cockpit were given below. The conversations were conducted in Korean language except for the parts indicated in *Italic style*.

((C) in below indicates the remarks made by the captain while (F) indicates those by the first officer.)

- 14m09s (C) What is at the center is a runway, isn't it? (about 3.6 nm)
12s (F) What?
13s (C) What is at the center is a runway, isn't it?
15s (F) Yes, yes.
16s (C) The one at the center, or which one?
17s (F) PAPI is on the left, PAPI is just beside. The runway is located on the right side.
22s (C) What is that looking wide on the right side?
25s (F) On the right side?
27s (C) Yes.
30s (C) Isn't that the runway? The one still looking wide?
35s (F) You mean the one on the right side?
37s (C) Yes, the one on the far right side.
38s (F) Ah, what is that on the left side? Captain, the left side · · ·
39s (C) That is so. PAPI is located in the distance?
42s (F) Yes, *one thousand, clear to land*.
44s (C) *Check*.
45s (C) Ah, it annoys me. It is obscure, is the wide one on the far right side the runway, isn't it?
51s (F) Yes, yes, yes.
52s (C) I'll make a landing there.
54s (Sound: Auto Pilot disengaged.)
57s (C) However, why is PAPI located far?
59s (F) Yes.
15m00s (C) First time to do 10 · · ·

02s (F) *One hundred above.* (Calling at the point 100 ft higher than MDA)
 04s (C) *Check.*
 06s (C) It annoys me, very much.
 07s (GPWS automatic call out: *Minimum.*)
 09s (C) *Landing.*
 10s (F) *Roger.*
 12s (GPWS automatic call out: *Five hundred.*)
 14s (C) *Stabilized.*
 15s (F) *Check.*
 17s (C) Ah, it looks that a new runway is under construction.
 20s (F) Yes.
 21s (C) It looks like.
 23s (F) Yes, that's right, Captain.
 24s (C) That is right, isn't that?
 25s (F) Yes.
 26s (DFDR [VNAV off]) (distance about 0.8 nm)
 28s (C) Oh, oh, ah-.
 32s (C) Seems grave, grave, ah-.
 36s (F) *F/D-off then on.*
 37s (C) *Flight director,-off then on.*
 41s (C) Yai-.
 46s (GPWS automatic call out: *50,40,30, 20, 10*)
 52s (C) Yah-.
 53s (DFDR [Ground altitude: 0ft])

After landing, realizing that the Aircraft had landed on a taxiway, the captain remarked, "But why is the indication like this, for the runway?"

2.1.2 Statements of the Operating Crewmembers and the Controllers

The statements of the captain are those taken directly by the Aircraft and Railway Accidents Investigation Commission (ARAIC) of Japan, combined with the captain's memo submitted immediately after this serious incident to "the Akita Airport / Air Route Surveillance Radar Office" and the results of interviews conducted by the Aircraft and Railway Accident investigation Board (ARAIB) of the Republic of Korea.

(1) Captain

To Akita Airport, I flew the final approach course toward YUWA VOR/DME (hereinafter referred to as "UWE") using LNAV and VNAV¹ modes for VOR No.1 approach. During the descent, it was raining moderately and the wind was blowing at approximately 30 kt at 2,000 ft.

At an altitude of around 2,000 ft, I saw a blurred shape of the aerodrome in the rain. There was a strong crosswind and the field of view was narrow because the wiper was

¹ LNAV means a lateral navigation function in which horizontal flight path guidance is computed and displayed by connecting way points using the flight management system (FMS). VNAV means a vertical navigation function in which vertical flight path guidance is computed and displayed during climb, cruise, or descent, using the FMS.

functioning.

Initially, I saw the PAPI² on the left-hand side, and because of the rain, I was under the false impression that it was located on the runway.

On the ND (Navigation Display), the Aircraft was indicated “on course” of VOR No.1 approach. On the HUD³, the FDGC(Flight Director Guidance Cue) was displayed on the same position as what it seemed like a runway. A few times during approach, the first officer and I tried to confirm if we were surely making an approach towards the runway, and I concluded that the indications on the ND, HUD, and the like were accurate.

I thought what was indicated on the ND, HUD and the like during VOR No.1 approach was the runway, so I landed as usual.

The reasons why I failed to identify the runway when I had descended and came out of the clouds are as follows;

- ① The FDGC on the HUD indicates the runway in usual VOR approaches, but in this approach procedure, it was not the case.
- ② Because visibility was very poor due to rain and we were using the wiper, and there was a large drift angle due to strong crosswind, it was quite difficult to confirm the runway.

In the end, I decided that at the center was located the runway, and disengaged the auto-pilot.

After changed from VOR approach to visual flight, I superimposed the FPS(Flight Path Symbol) on the position where I thought there was the runway, and landed there.

I did not know that the approach course of the VOR No.1 approach was exactly the same bearing of 105° as the runway direction, and the extended line beyond UWE was roughly leading to the taxiway. Moreover, the information concerning this issue was not available prior to the flight. I noticed during landing roll that I had landed on a taxiway.

I do not clearly remember but I have flown to Akita Airport several times over the past three years. I had landed on runway 28 only, and this was the first time for me to land on Runway 10.

The communication condition with Akita Tower was good and without any problems.

The Aircraft is equipped with a HUD for the left pilot seat only, and I always use it for take-offs and landings, and I landed using it in PRI mode⁴ in this flight, too.

(2) First officer

There was no turbulence while descending on VOR No.1 approach. Meteorological conditions were good at high altitude but there was moderate rain at a lower altitude, and the

² PAPI (Precision Approach Path Indicator) is usually installed on the left-hand to the runway viewed from the approaching aircraft at a location near the touchdown point and provides a precise approach angle up to the threshold.

³ HUD (Head Up Display) is a device that indicates information necessary for flight on a transparent panel installed in front of the pilot. The pilot can read flight information while viewing outside. (See Attached Materials 1 and 3.)

⁴ PRI mode (Primary mode) is one of the display functions of HUD. Pilots can select a display function appropriate to each flight condition, and PRI mode can be used in all flight conditions. (See Attached Material 1.)

rain continued until landing. The wind was about 40 kt at around 3,000 ft from between 160° and 170° direction.

I could see the aerodrome at an altitude of approximately 2,000 ft or below, at 4 to 5 nm. As it was raining, the runway could not be seen clearly, and was obscure, so it looked like as though there were two runways. Because PAPI was on the left-hand side, I said to the captain, "The runway is just beside PAPI, isn't it?" As we made the approach not knowing which was the runway, I thought that there was something not quite right because PAPI was far apart, so I saw the airport chart, in which the runway direction was 105° and the LNAV course was also 105° , and thought we were on the right course because our approach course was the same as that. I thought the one I saw in front of us was the runway.

It was after landing that I realized that it was a taxiway.

On the navigation display, MAP mode (the LNAV route, way points and the like are displayed) was selected for the captain side, and VOR mode, then on final, MAP mode was selected for the first officer side.

(3) Controller A of Akita Tower in charge of radio communication with the Aircraft

I received a first contact from the Aircraft at around 12:06, reported the aerodrome information and requested a position report at OMONO. Then, upon receiving the report of passing OMONO, I issued the landing clearance.

I could see the Aircraft at approximately 2 nm, and kept seeing it, but I did not notice that the Aircraft was making an approach to the taxiway. When it passed around the threshold of Runway 10, I noticed something wrong but it was too late to take any measures, and the Aircraft landed on the taxiway. Its touchdown point was abeam to the aiming point marking of the runway, and touchdown was made as usual. After the Aircraft stopped, I issued the instruction for taxiing to the apron.

There was nothing unusual about radio communication prior to the landing.

(4) Controller B of Akita Tower in charge of coordination

The weather at that time was in visual meteorological conditions and the ceiling was 4,000 ft. Observed visibility was 10 km, but I felt that visibility on the approach side of Runway 10 was a little worse. I did not turn on the runway lights because of the visual meteorological conditions, but I turned ALB⁵ on to help approach.

I could see the Aircraft at about 2 nm. Although I felt it was slightly low at about 1 nm, it was approaching normally. It landed on the taxiway before I realized what happened.

UWE used in VOR No.1 approach is located 0.8nm west of Runway 10 threshold, and offset to the south of the extended centerline of the runway. Therefore, approaching aircraft make a sidestep into the runway when they come close to UWE, or they fly towards the runway from early stage, and which way to choose depends on each pilot.

This serious incident occurred on the taxiway of Akita Airport (latitude 39° 37' North, and longitude 140° 11' East), at approximately 12:16.

(See Figures 1, 2 and 4, Photos 1 and 2, and attachment 1, 2, and 3.)

⁵ ALB (Approach Light Beacon)s are flashing lights installed on the extended centerline of the runway to indicate the approach course for landing aircraft.

2.2 Crew Information

(1)	Captain	Male, Age 50 years	
	Airline Transport Pilot License (Airplane) (issued by the Republic of Korea)		January 24, 2002
	Type rating for B737-800 ⁶		
	1 st class aviation medical certificate (issued by the Republic of Korea)		
	Validity		Until March 31, 2007
	Total flight time		9,487 hr and 11 min
	Flight time in the last 30 days		45 hr and 10 min
	Flight time on the aircraft type		2,389 hr and 18 min
	Flight time in the last 30 days		45 hr and 10 min
(2)	First officer	Male, Age 31 years	
	Commercial Pilot License (Airplane) (issued by the Republic of Korea)		March 4, 2004
	Type rating for B737		
	1 st class aviation medical certificate (issued by the Republic of Korea)		
	Validity		Until February 28, 2007
	Total flight time		1,052 hr and 24 min
	Flight time in the last 30 days		46 hr and 03 min
	Flight time on the aircraft type		763 hr and 29 min
	Flight time in the last 30 days		46 hr and 03 min

2.3 Aircraft Information

2.3.1 Aircraft

Type	Boeing 737-900
Aircraft serial number	29998
Date of manufacture	April 9, 2004
Certificate of airworthiness (issued by the Republic of Korea)	AS05086
Total time in service	4,499 hr and 37 min
(See Figure 3.)	

2.3.2 Weight and Balance

At the time of this serious incident, weight of the Aircraft was calculated 135, 565 lb and its center of gravity at 19.8% mean aerodynamic chord (MAC), both of which are estimated to have been within the allowable limits (146, 300 lb for the maximum landing weight , and the center of gravity ranging from 6.0 to 36.0% MAC on the calculated aircraft weight at the time of this serious incident).

2.4 Meteorological Information

2.4.1 Meteorological Data Observed at Akita Airport

12:00 Direction of wind...140° , Wind velocity...9 kt, Prevailing visibility...10 km, Present weather... light rain, Clouds: amount... 1/8, type...

⁶ The type rating of 737-800 includes 737-900 as well according to the Korean CASA.

stratocumulus, ceiling... 2,000 ft, amount...7/8, type...stratocumulus, ceiling...4,000 ft, Temperature...4° C, Dew point... 2° C, Altimeter setting (QNH)... 29.84 inHg

12:44 Direction of wind...120° , Wind velocity...9 kt, Prevailing visibility...10 km, Present weather...light rain, Clouds: amount...1/8, type...stratus, ceiling... 200 ft, Amount...7/8, type...stratocumulus, ceiling...3,500 ft, Temperature...4° C, Dew point...3° C, Altimeter setting (QNH)... 29.82 inHg

Akita Airport and the adjacent plains were not covered with snow, and the areas surrounding the runway were covered with withered grass.

2.4.2 Forecast for Akita Airport for Short-range Flight announced at 08:00 (TAF-S)

TAF Forecast for 9:00 to 18:00

Actual condition: Direction of wind...130° , Wind velocity...10 kt, Prevailing visibility...10 km and over, Clouds: amount...1 to 2/8, ceiling...1,000 ft, amount...5 to 7/8, ceiling...4,000 ft, amount...5 to 7/8, ceiling...7,000 ft

Forecast for 09:00 to 13:00: No change

Forecast for 13:00 to 15:00: The weather will gradually change between 13:00 and 15:00, with prevailing visibility of 4,000 m, and there will be light rain and it will be misty.

2.4.3 Wind and Heading recorded on the DFDR during the Final Approach of the Aircraft

Time	Pressure altitude	Wind direction/velocity	Heading
12h12m35s	2,693 ft	188° /35 kt	117.8°
12h14m09s	1,550 ft	156° /32 kt	116.0°
12h14m42s	1,143 ft	147° /31 kt	113.9°
12h14m54s	1,015 ft	140° /30 kt	112.9°
12h15m07s	871 ft	136° /26 kt	112.1°
12h15m17s	749 ft	134° /26 kt	111.1°

(The heading in the right-hand column includes the crosswind correction angle to maintain the flight path of 105° of the Aircraft.)

2.5 Information on DFDR and CVR

The Aircraft was equipped with a DFDR (Part Number 980-4700-042) manufactured by Honeywell Inc. of the U.S.A. and a CVR (Part Number 980-6022-001) capable of recording 120 minutes, manufactured by Honeywell Inc. of the U.S.A.

The DFDR and the CVR retained data relevant to this serious incident. The DFDR time was calibrated by comparing the operation data of the VHF transmission key used for the air traffic control communication with the time of the air traffic control communication records.

2.6 Information on the Serious Incident Site

2.6.1 Runway and Taxiway

The runway10/28 is 2,500 m long and 60 m wide, with magnetic bearing of 105° / 285° , and the elevation of Touch Down Zone of Runway 10 is 289 ft. ILS is provided only for Runway 28. On the runway, there are markings including runway end markings, touchdown

zone markings, aiming point markings, and centerline markings, which are indicated in yellow so as to provide better visibility in snow, and the centerline markings are 90 cm wide broken lines.

The taxiway, which runs parallel to the runway, is a 30 m-wide asphalt-concrete paved surface, and its strength is the same as that of the runway. About 300 m of its central part is an apron taxiway with a concreted surface. The taxiway centerline marking is indicated with a 15 cm-wide yellow continuous line. Also, paved shoulders of the runway and taxiway are 10 m and 7.5 m in width, respectively, so the paved widths in total are 80 m for the runway and 45 m for the taxiway.

PAPI of Runway 10 is installed with an approach angle of 3° , at a position 420 m beyond the threshold, 15 m to the left of the runway edge viewed from the approaching direction, and the width of the lights is 27 m.

The distance between the centerlines of the runway and the taxiway is 184 m.
(See Figure 1.)

2.6.2 VOR No.1 approach

The instrument approach procedure for Runway 10 is a straight-in approach from the sea to the west of Akita Airport toward UWE by magnetic course of 105° . The Minimum Descent Altitude (MDA) is defined as 760 ft of pressure altitude, and the approach limit point is UWE. Also, the Visual Descent Point (VDP)⁷ is defined at 0.5 nm before UWE.

UWE is located at 0.8 nm to the west from the threshold of the Runway 10, and 150 m to the south from the extended centerline of the runway. The approach course of 105° to UWE is in parallel with and the same as the direction of Runway 10. If the course is extended in the direction of 105° from UWE to the aerodrome, it does not lead to the runway centerline but 34 m north of the taxiway centerline.

The missed approach course is defined as to climb from UWE via 105° course of UWE.

In addition, this approach procedure is established based on “the Design Criteria for flight procedure” (“Kokukuusei-No.111” dated July 7, 2006) which is established by the Japan Civil Aviation Bureau(JCAB) of Ministry of Land, Infrastructure, Transport and Tourism. The criteria is established based on ICAO PANS-OPS Vol. II “Construction of Visual and Instrument Flight Procedures” I-4-5 5.2.2.

(See Figures 1, 2 and Attachment 4.)

2.7 Information on Organization and Management

2.7.1 Route Qualification of the Company

The Flight Operations Manual (hereinafter referred to as “FOM”) of the Company sets forth the route qualifications of the captain as follows:

Flight Operations Manual
3.3.1 (08 SEP 2006)

⁷ VDP (Visual Descent Point) is a defined point on the final approach course of a non-precision straight-in approach procedure from which descent below the Minimum Descent Altitude can be commenced, provided that visual aids enabling identification of the threshold of that runway, such as approach lights, are visible. Usually, VDP is defined at the point where a descent path corresponding to a glide slope of PAPI reaches the MDA.

FLIGHT CREW Qualification

Route and Airport Qualification

□ Route Qualification Requirements

- No PIC may operate to a region unless he made a single flight or more to at least one route to that particular region within the preceding 12 calendar months.*

With regard to the above-mentioned regions, airports in Japan belong to the Asia Area/Route. The captain had had experience flying to five airports in Japan (other than Akita Airport) in 2006.

2.7.2 Crew Resource Management (CRM) Training of the Captain and First Officer

The table below shows the CRM training given in 2006 in accordance with the Company manuals.

Training items	Date conducted for captain	Date conducted for first officer
CRM SKILLS & JCRM	October 17	February 2
LOFT	November 29	April 10
EMC REFRESHER	—	February 21

(Note) JCRM: Joint CRM

LOFT: Line Oriented Flight Training

EMC: Error Management Course

2.7.3 Career of the Captain and First Officer

(1) Captain

Having served in the Air Force of the Republic of Korea, the captain was hired by Korean Air Lines Co. Ltd. in November 1993, and obtained from the company qualification of captain for Cessna 560 in January 2000 and for Boeing 737 in December 2003.

He had once flown to Akita Airport as a first officer in 2003, and then twice in 2004 as a captain, and landed on Runway 28, but had no experience of landing on Runway 10. In addition he had no experience of VOR No.1 approach simulation for Runway 10 in the Company..

(2) First officer

After graduating from a flight school, the first officer joined the Company in January 2005, and has been working as a first officer of Boeing 737 since October 2005.

He had flown to Akita Airport twice in March and once in May 2006 as a first officer, and landed on Runway 28, and had no experience of approach for Runway 10.

2.8 Fact-Finding Tests and Research

2.8.1 Outline of HUD

In a glass cockpit aircraft, flight information such as altitude, airspeed, course and attitude, are displayed electronically on the PFD(Primary Flight Display). HUD is a device to project PFD information on a transparent panel (Combiner) installed inside the windshield. As the projection is focused in the infinite distance, the pilot can see the outside and the projected flight information while focusing his eyes on the outside without heading down to see the instrument panel.

A pilot can select a display mode among PRI (Primary), A III approach, IMC and VMC,

depending on the flight phase. The PRI mode can be used in all circumstances, from takeoff to landing.

Among displayed symbols, there is a FPS, which indicates the actual flight vector of the aircraft. Moreover, it is possible to display the FDGC as an FD function for directing flight vector.

When FMS has the path data base including altitude, if LNAV and VNAV modes are engaged, and FD is turned on, then the FDGC guides the horizontal and vertical path, therefore, when the displayed FPS is overlapped on the FDGC, the aircraft is flying the preselected path including altitude (such as climb, cruise, and descent).

Lateral movement of FPS is limited on the display. In such case, FPS is displayed in ghost that is, indication is changed from solid line to broken line. Under such conditions, the FPS does not mean the actual flight vector. In PRI mode, the FPS is displayed in ghost when it is more than about 7.3° apart laterally from the heading.

2.8.2 Non-Precision Approach using HUD

The Aircraft is capable of flying on the instrument approach course by auto-pilot using the LNAV and VNAV, and the FPS and FDGC are overlapped on the HUD if FD is on.

If a pilot judges it possible to make a visual landing before reaching VDP in the course of a non-precision approach, then he deletes the FDGC from the display (turns the FD off), aligns the FPS on the HUD with the extended line of the runway centerline by manual operation, and makes a landing approach by superimposing the FPS on the touchdown aiming point.

The GsRL(Glide slope Reference Line) indicates the pitch angle manually set (usually 3°) on the HUD for landing approach. By retaining the GsRL on the touchdown aiming point, and by superimposing the FPS on the GsRL, the landing approach can be made on the proper path.

In case of most non-precision approach procedures, the approach course does not coincide with the extended line of the runway centerline; in such case, if the aircraft is located on the extended line of the runway centerline with LNAV engaged, the FPS is displayed apart horizontally from FDGC, which continuously indicates the instrument approach course. (See Attachments 1 and 3.)

2.8.3 LNAV and VNAV

FMS or FMC (Flight Management Computer) of the Aircraft had LNAV path data which started from the STAR, passing OMONO by VOR No.1 approach course of 105° , and ended at UWE. It had VNAV path data to pass OMONO with descent angle at 3° so as to fly to the final fix UWE at the altitude of 594 ft.

2.8.4 Manual of the Company on HUD Usage

The FOM of the Company states that for aircraft equipped with HUD it is recommended to use HUD from takeoff to landing.

The captain has been using HUD since he obtained rating for the type of the Aircraft. However, according to the DFDR records of this flight, HUD was OFF during cruise, and ON since about ten minutes before landing (12h05m06s).

2.9 Aerodrome Lights

As described in 2.1.2 (4), the controller of Akita Tower turned on ALB although it was in visual meteorological conditions. The ALB was lit at 12h12m33s, about two seconds before the first officer visually confirmed the runway. The controller did not inform the Aircraft of his turning on the ALB. Meanwhile, other aerodrome lights were ready to be lit at any time.

As to the standards of aerodrome lights management, the “Manual of Aviation Safety Services” established by the Japan Civil Aviation Bureau stipulates the operation standards in Volume 7, Lights and Electric Facilities, as follows:

(III) Operation Standards (Excerpt)

1 Operation Method

(1) With regard to the aerodrome lights, operation will be conducted in accordance with the following:

b Lights (excluding the aerodrome beacon and auxiliary aerodrome beacon) are to be lit when it is deemed necessary in case that aircraft takes off or lands, or in case to assist overflying aircraft, according to the followings:

(c) When requested by a pilot, meet the request as far as possible

(d) Turn on the lights whenever it is deemed necessary.

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 specified program.

3.3 Weather Conditions

(1) Aerodrome visibility

As described in 2.4.1, in the 12:00 weather report the prevailing visibility was 10 km, and it was in visual meteorological conditions. However, it is considered that the ground visibility in a direction of final approach course of Runway 10 was less than 10 km at the time of this serious incident, as the controller of Akita Tower stated that he saw the Aircraft at a distance of approximately 2 nm.

(2) Flight visibility

As described in 2.1.1 and 2.1.2, the captain and the first officer made a call of “runway in sight” at a distance of approximately 7.4 nm from the threshold of Runway 10. Then, based on the conversation made at a distance of around 3.6 nm, it is estimated that they were able to maintain the aerodrome in sight, although it was not easy to see it due to rain.

3.4 Analysis of the CVR

As to the CVR records described in 2.1.1, according to the interviews conducted by the Korean ARAIB, it is estimated that neither the captain nor the first officer remembered clearly their remarks during the final approach. For this reason, their intentions of the conversation and details of their recognition of the situation could not be confirmed.

3.5 Analysis of the Process of Misidentification of the Runway and Landing

3.5.1 Misidentification of the Runway

As described in 2.1.1, according to the conversation between 14m09s and 14m52s recorded by the CVR, it is estimated that the captain mistook the taxiway for the runway. And he said, "I'll make a landing there" at 14m52s. It is estimated that the first officer also agreed with the captain in the course of the conversation.

As described in 2.1.2 (2), because the first officer said, "It looked like as though there were two runways", it is considered that the captain saw the runway likewise. It is considered that their failure to distinguish the runway from the narrower taxiway, which is located on the right-hand side of the runway, was caused by such reasons that the captain and the first officer forgot and did not reconfirm the relative locations of the runway and the taxiway, that visibility was poor due to rain, that they saw the runway in the distance when the Aircraft was heading rightward in the strong crosswind and its flight path was nearly aligned with the taxiway, and that it was difficult to see boundary of the rain-wet taxiway.

Under such circumstance, because the captain mistakenly assumed that the VOR approach course was heading toward the runway, and the FDGC, LNAV, and the like indicate direction to the runway, it is considered that he mistook the right side taxiway for the runway, assuming that the one corresponding to the flight path was the runway. Meanwhile, it is considered that although the first officer at first correctly recognized the runway based on the position of PAPI, he misunderstood that the LNAV course were leading to the runway, and agreed with the captain. Furthermore, concerning that the captain and the first officer mistakenly interpreted the indication of the instruments, it is considered contributory that they did not know that VOR No.1 approach course ran in parallel with the runway, and that its extended line was nearly superposed on the taxiway.

Because the captain continued an approach relying on HUD and ND indications when he should have made a visual approach after he got the runway in sight, it is considered that his attention to the outside view was diminished, and thereby he was unable to correct his mistake.

Even under the visual meteorological conditions, if there was any uncertainty about visual identification of the runway, the captain should have taken such measures to ensure correct identification of the runway as requesting the lighting of the runway lights or confirming the aerodrome chart, but it is considered that he did not consider it necessary to use various confirmation measures due to his misunderstanding that the indication of the instruments points to the runway.

3.5.2 Landing

It is estimated that the FDGC display on the HUD went off since the Aircraft passed UWE. Then, as described in 2.8.2, it is estimated that the captain flew the Aircraft by superimposing the FPS indicating aircraft path and GsRL which were displayed on the HUD, on the taxiway he was seeing ahead, and landed on the taxiway maintaining the 3° path.

It is considered that the captain entered touchdown maneuver, focusing his attention to align the FPS on the centerline of the taxiway, and it is considered that he failed to recognize that the centerline of the taxiway is a fine continuous line, that there were no touchdown zone markings, and so on, thereby he was unable to reach judgment that it was not a runway.

As described in 2.8.1, the HUD display focus is infinite and the runway could be seen without changing visual focus through the HUD, but it is considered that the captain paid much

of his attention to the HUD display, and did therefore not pay enough attention to the outside view.

After the captain said, "I'll make a landing there", and changed from auto-pilot to manual operation, the first officer responded to captain's remarks, such as "PAPI located far" or "a new runway", however, it is considered that as the first officer started to pay attention to duty monitoring within the cockpit and hardly saw the outside, it is considered that he could not point out the mistake of the captain.

3.6 Landing Approach Using HUD

The HUD is a device that enables a pilot to fly while looking outside, which, at the time of landing, enables the pilot to make a stabilized landing by accurately ascertaining the touchdown point by seeing both the HUD display and the outside (runway).

It is considered that the HUD is an effective device for assisting pilots in flight. In the case of this serious incident, it is considered that one factor in the misunderstanding stems from the fact that the most basic part, to ensure visual identification of the runway, was not performed.

For an ILS approach in which the approach course coincides with the runway direction, the FDGC on the HUD displays the touchdown aiming point correctly if devices are operating normally. However, for a non-precision approach or a visual approach, it is critical to confirm the touchdown aiming point visually without depending on the FDGC.

The captain stated in the interview, "I concluded that the indications on the HUD and the like were accurate." therefore it is estimated that he mistakenly supposed that the FDGC on the HUD indicated the direction towards the runway.

Moreover, in this serious incident, it is considered possible that the captain had been preoccupied by the HUD display and did not make sufficient outside watching. It is desirable that the operators of aircraft equipped with HUD pay attention to the importance of looking outside visually even when HUD is in use.

3.7 Experience of the Captain

As described in 2.7.3, although it was the first experience for the captain to land on Runway 10 of Akita Airport, it is considered possible that he might not re-confirm the aerodrome chart very carefully because he had had experience of landing in the opposite direction in the past and the report of meteorological observation indicated it was in visual meteorological conditions.

As for the use of HUD, as described in 2.8.4, it is considered that the captain had had approximately the same amount of experience as numbers of landings he had made with the type of the Aircraft over a period of about three years.

In addition, as described in 2.1.2(1) and 2.7.3(1), it is considered that the captain had not been aware that the final approach course of VOR No.1 approach was parallel to the runway, and its extended line was nearly superposed on the taxiway.

3.8 CRM of the Operating Crewmembers

The CRM includes that the captain and the first officer are in performing their duties to mutually check each other's wrong impressions or mistakes and to complement each other.

In this serious incident, it is considered possible that the captain and the first officer did not complement each other sufficiently, as they did not use appropriate confirmation means

before mistakenly identifying the runway, they missed chances to correct the misidentification because they had believed wrong impressions, and they did not know that the course of VOR No.1 approach was in parallel with the runway, pointing to the taxiway.

3.9 Effectiveness of Aerodrome Lights

When aerodrome weather is in instrument meteorological conditions, aerodrome lights are turned on even in daytime, but they are not in visual meteorological conditions. However, the manual says that aerodrome lights can be turned on in response to the request from a pilot. Even when it is in visual meteorological conditions just as in this serious incident, there are cases in which flight visibility on the approach course is poor due to the reasons such as rain, thin clouds or mist.

When the captain got the aerodrome in sight, even if the visual meteorological conditions had been reported, he should have requested that the aerodrome lights be lit if he had felt any uncertainty about maintaining the runway in sight thereafter. It is estimated that this serious incident could have been prevented if the captain had requested to turn the lights on, upon his doubt about the position of the runway.

3.10 Support of Controllers to Aircraft

As described in 2.1.2, it was about when the Aircraft had entered over the taxiway that the controller of Akita Tower noticed that the Aircraft was making a wrong approach.

Although the controller stated that he had maintained a continuous watch of the Aircraft, it does not mean that he has been fixing his eyes on the Aircraft on the final approach. And he has been looking at the Aircraft on final from the diagonal line to the final approach course. Therefore it is estimated that the controller was unable to notice the wrong approach. As described in 2.1.2(4), since the aligning point to the extended runway centerline varies depending on each pilot in case of VOR No.1 approach and also a controller cannot estimate the aligning point, it is estimated that it was difficult for the controller to be aware of the wrong approach at an early stage before entering the airport field

By the time he realized the wrong approach, the Aircraft had already been on the verge of touchdown, and it is estimated that it was no longer possible to instruct the Aircraft to execute a go-around.

Moreover, the other controller, recognizing that visibility had worsened due to rain, turned on the ALB only for the support to the Aircraft in spite of not under IMC; however, the support was not effective because the Aircraft did not notice the lights.

If the controller had notified about lighting of the ALB to the Aircraft, it is considered possible that the Aircraft might have paid attention to them, and it is considered possible that the support might be effective.

3.11 Notes on VOR No.1 Approach

As described in 2.6.2, the final approach course bearing of VOR No.1 Approach is the same as the runway direction and the extended line of that approach course does not intersect with the extended runway center line, however the relative position of both extended lines meets the ICAO standard.

A landing by non-precision approach is on the premise that a pilot gets the runway in sight before VDP. In addition, it is prescribed in the ICAO PANS-OPS that an approach procedure

to be published as “a straight in approach” under the condition that the relative position between the final approach course and the extended runway center line meets certain ICAO standard, and that the approach procedure under the other condition to be published as “a circling approach”. There are no definitions in ICAO standard to require the description on the relative position between the final approach course and the extended runway center line for the publication on both of “straight-in approach” and “circling approach”. “The Design Criteria for flight procedure” of JCAB was established based on the same ICAO standard and the description on the relative position between the extended line of the final approach course and the extended runway center line was not added to the publication on VOR No.1 Approach.

Since there are some cases when we cannot get the detail information on the relative position between the final approach course and the extended runway center line in the publications, aircraft operators should exert efforts to provide necessary information to own company cockpit crews.

In addition, just as described above, although it is not generally required to describe the relative position of the extended final approach course and the extended runway center line in the publication of the non-precision approach meeting certain standard, considering this serious incident on the wrong landing to the taxiway by VOR No.1 approach, it is desirable to examine the necessity to describe the relative position in the publication of VOR No.1 approach.

4 PROBABLE CAUSE

It is estimated that this serious incident was caused by that the captain and the first officer made a landing by misidentifying the parallel taxiway for the runway.

Concerning this misidentification, such factors are considered contributory as forgetting and failing to reconfirm the relative location between the runway and the taxiway, deterioration of local visibility under the visual meteorological condition and the lack of knowledge about the fact that VOR No.1 approach course runs in parallel with the runway. In addition, it is considered that captain’s mistaken belief that the FDGC in the HUD display had indicated direction to the runway was also a contributory factor.

5 REFERENTIAL MATTERS

After this serious incident, Korean Air Lines Co., Ltd. added and modified *The Airway Manual* which is compiled as the reference material for operating crewmembers, as follows:

KOREAN AIR (K-2)

AKITA INT’L

Arrival Information

(Omitted)

Caution) Because YUWA VOR is located on the extension of the taxiway, should be cautious not to confuse runway with taxiway when using VOR DME RWY 10 APP. When visibility is poor due to fog or snow, pilots should pay special attention. (Refer to page K-5)

(K-5)

(Positions of the runway, taxiway, and YUWA VOR/DME have been added to the photos of the aerodrome.)

6 Comments from the Republic of Korea

ARAIC received the official comments on the draft final report from the accredited representative of the Republic of Korea, the State of the Operator and the State of Registry.

In accordance with the paragraph 6.3, Chapter 6 “FINAL REPORT”, Annex 13 to the Convention on International Civil Aviation, ARAIC attaches the comments to this report that have not been reflected in this report.

(See attachment 5)

Figure 1 Estimated Flight Path

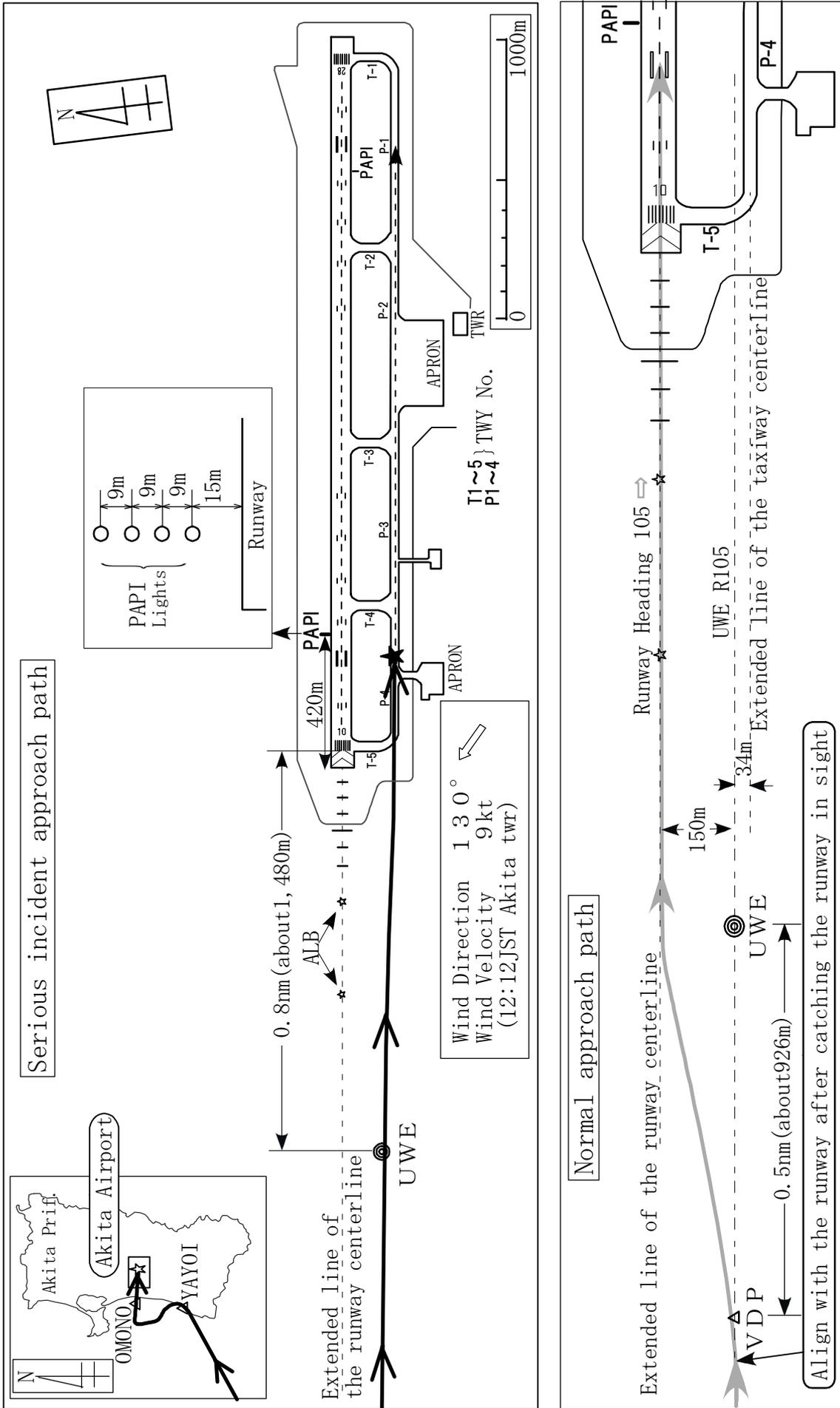
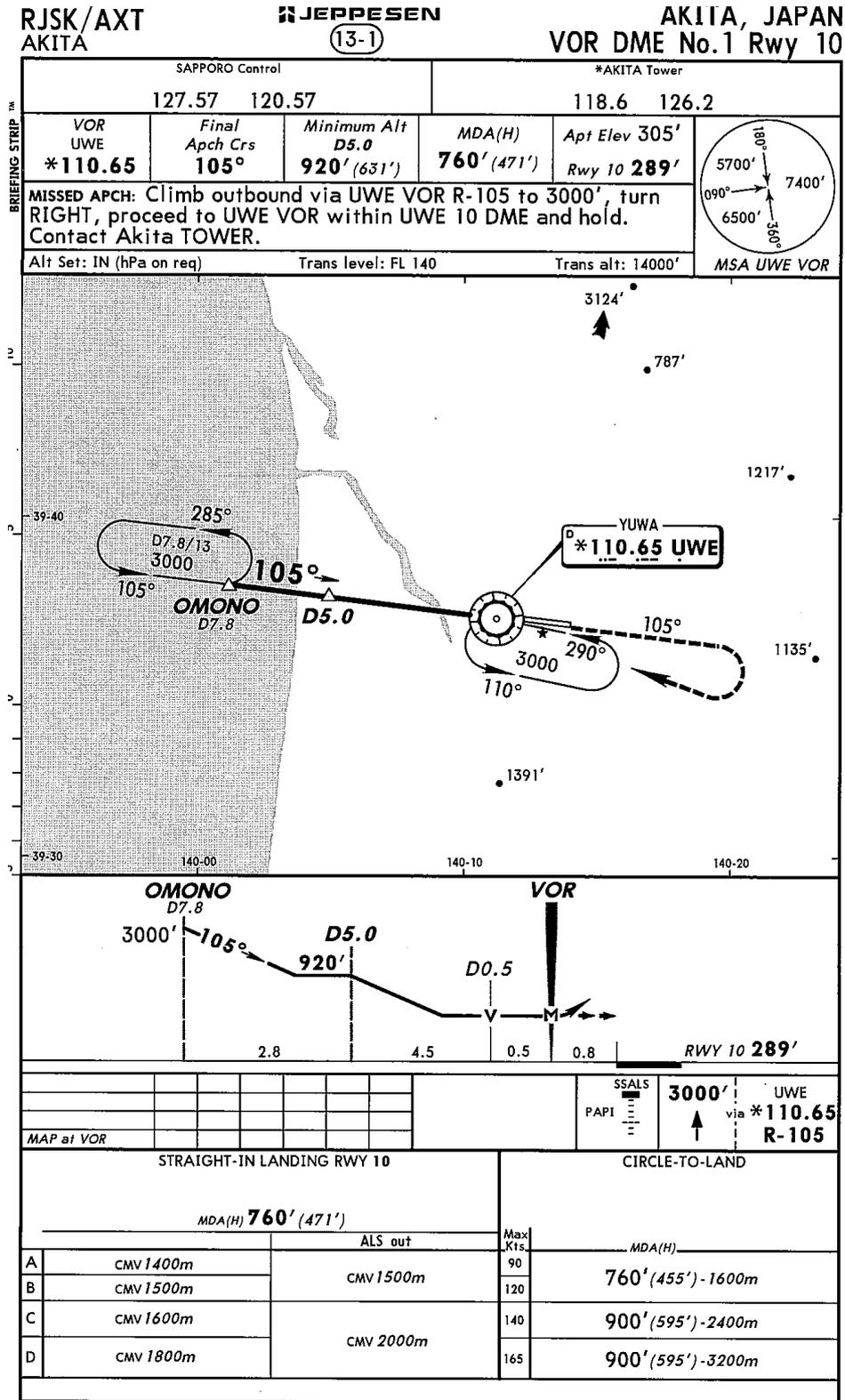


Figure 2 VOR/DME No.1 Rwy 10 Approach Chart



CHANGES: Minimums.

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Figure 3 Three angle view of Boeing 737-900

Unit:m

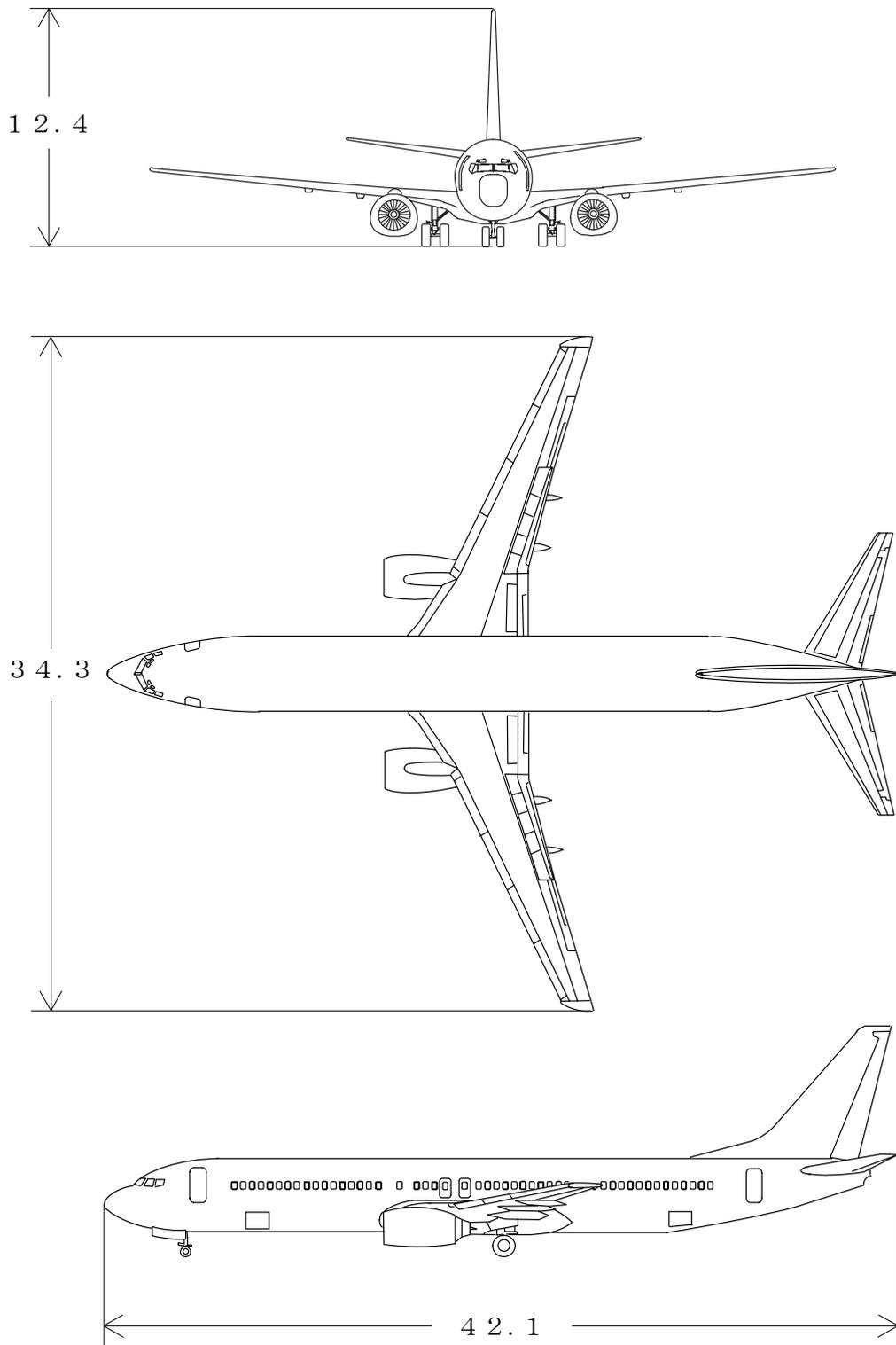


Photo 1 The Aircraft



Photo 2 Cockpit equipped with HUD

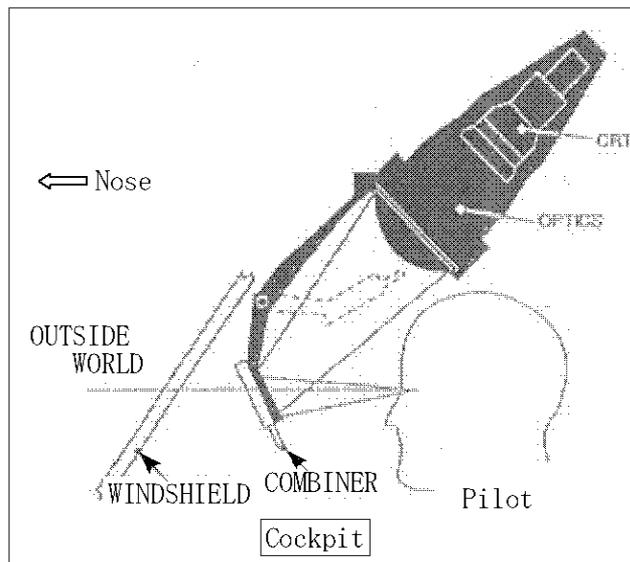
(Flight Simulator)

HUD

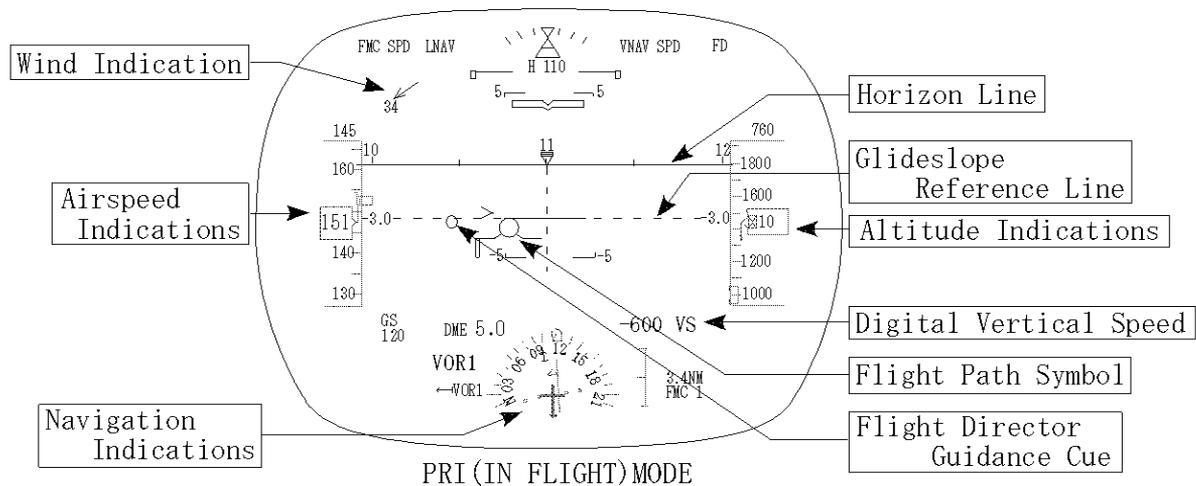


Attachment 1 [HUD]

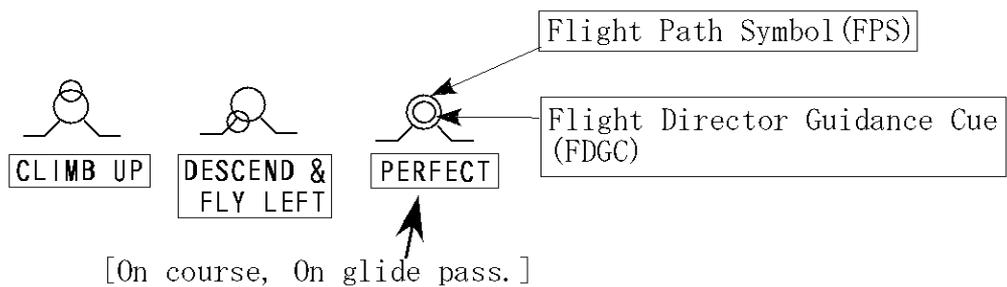
1 Head Up Display



2 HUD PRI (Primary) Mode



3 Flight Path Symbol & Flight Director Guidance Cue



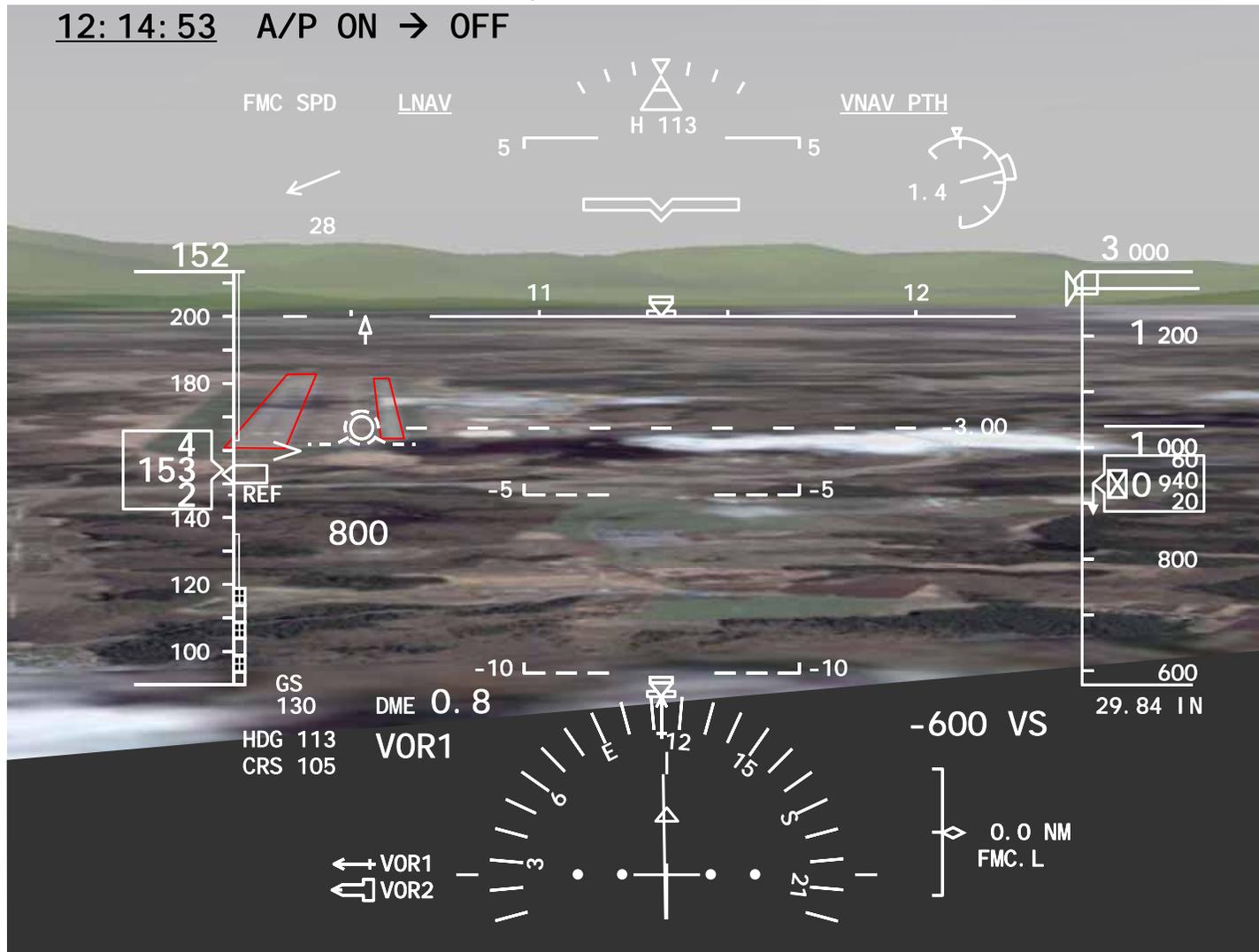
Attachment 2 CVR

JST	SRC	Contents(Original)	Engulish
12:11:57	F/O	Akita Tower KE769, now passing OMONO.	Akita Tower KE769, now passing OMONO.
12:12:01	TWR	KE769, Runway 10, clear to land, wind 130 at	KE769, runway 10, clear to land, wind 130 at 9.
12:12:07	F/O	Roger. Cleared to land, runway 10, KE769	Roger, cleared to land, runway 10, KE769.
12:12:10	CAP	예, Landing Checklist.	Yes, landing checklist.
12:12:12	F/O	Before landing checklist.	Before landing checklist
	CAP & F/O	(Checklist 수행...)	(Performing Checklist...)
12:12:22	F/O	Before landing checklist completed, sir.	Before landing checklist completed, sir.
12:12:35	F/O	Runway in sight.	Runway in sight.
12:12:36	CAP	아, 저기 보이는구나.	Ah, I have it in sight.
12:12:45	CAP	자, 이것을...	Well, this one...
12:12:48	F/O	Radio altimeter - alive.	Radio altimeter - alive.
12:12:50	CAP	Check.	Check.
12:13:03	CAP	예, Missed approach altitude 3,000 feet set.	Ah, missed approach altitude 3,000 feet set.
12:13:05	F/O	예, 3,000 feet check.	Yes, 3,000 feet check.
12:13:11	F/O	Passing final approach fix.	Passing final approach fix.
12:13:13	CAP	Yes, sir. 바람이 이거 언제쯤 줄어들거야?	Yes, sir. When will this wind decrease ?
12:14:09	CAP	가운데 있는게 활주로 맞지?	What is at the center is a runway, isn't it?
12:14:12	F/O	네?	What ?
12:14:13	CAP	가운데 있는게 활주로 맞지?	What is at the center is a runway, isn't it?
12:14:15	F/O	네, 네.	Yes, yes.
12:14:16	CAP	어, 가운데 있는거야, 어떤거야?	The one at the center, or which one ?
12:14:17	F/O	PAPI 가 왼쪽에, PAPI 가 바로 옆에가, 오른쪽 옆에 입니다.	PAPI is on the left, PAPI is just beside, the runway is located on the right side.
12:14:22	CAP	오른쪽에 넓게 보이는거 뭐야.	What is that looking wide on the right side ?
12:14:25	F/O	오른쪽예요?	On the right side ?
12:14:27	CAP	응.	Yes.
12:14:30	CAP	저게 활주로 아냐? 그래도 넓게 보이는거?	Isn't that the runway? The one still looking wide ?
12:14:35	F/O	오른쪽 거요?	You mean the one on the right side ?
12:14:37	CAP	응, 제일 오른쪽 거.	Yes, the one on the far right side.
12:14:38	F/O	아, 왼쪽에 있는건 험니까? 기장님, 왼쪽....	Ah, what is that on the left side ? Captain, the left side...
12:14:39	CAP	그러게 말이야. PAPI가 멀리서 가서 있지?	That is so. PAPI is located in the distance?
12:14:42	F/O	네, One thousand, clear to land.	Yes, one thousand, clear to land.
12:14:44	CAP	Check.	Check.
12:14:45	CAP	아, 골 때린다. 애매하네, 아주 맨 오른쪽에 넓은게 활주로 맞지?	Ah, it annoys me. It is obscure, is the wide one on the far right side the runway, isn't it?
12:14:51	F/O	네, 네, 네.	Yes, yes ,yes.
12:14:52	CAP	글루 내려야겠다.	I'll make a landing there.
12:14:54	GPW	(Sound : Auto Pilot disengaged)	(Sound : Auto Pilot disengaged)
12:14:57	CAP	그런데 왜 PAPI를 멀리 해 봤지?	However, why is PAPI located far?
12:14:59	F/O	네.	Yes.

JST	SRC	Contents(Original)	English
12:15:00	CAP	10 는 처음해 보니까...	First time to do 10...
12:15:02	F/O	One hundred above	One hundred above.
12:15:04	CAP	Check.	Check.
12:15:06	CAP	곧 때리네, 아주.	It annoys me, very much.
12:15:07	GPW	Minimum	Minimum.
12:15:09	CAP	Landing.	Landing.
12:15:10	F/O	Roger.	Roger.
12:15:12	GPW	Five hundred.	Five hundred.
12:15:14	CAP	Stabilized.	Stabilized.
12:15:15	F/O	Check.	Check.
12:15:17	CAP	아, 저게 새 활주로 만들고 있는건가 보다.	Ah, it looks that a new runway is under construction.
12:15:20	F/O	네.	Yes.
12:15:21	CAP	그런거 같은데.	It looks like.
12:15:23	F/O	네, 이거 맞습니다. 기장님	Yes, that's right, Captain.
12:15:24	CAP	그렇지 ?	That is right, isn't that ?
12:15:25	F/O	네.	Yes.
12:15:28	CAP	어어, 아~	Oh, oh, ah~.
12:15:32	CAP	힘약하게, 힘약하게 생겼다. 아이~.	Seems grave, grave. Ahi~
12:15:36	F/D	F/D - off then on.	F/D - off then on.
12:15:37	CAP	Flight Director, off then on.	Flight director - off then on.
12:15:41	CAP	아이~	Yai~
12:15:46	GPW	50, 40, 30, 20, 10	50, 40, 30, 20, 10.
12:15:52	CAP	야~	Yah~
12:15:54	F/O	Speed Brake - up.	Speed brake - up.
12:16:02	F/O	기장님, 저희 taxiway에 내린거 같은데요.	Captain, we seem to have landed on a taxiway.
12:16:05	CAP	여기?	Here ?
12:16:07	F/O	Taxyway 아닙니까, 이거?	Isn't this a taxiway, this one ?
12:16:08	CAP	이거 Taxiway 야?	Is this a taxiway ?
12:16:09	F/O	예.	Yes.
12:16:12	F/O	Taxiway 에 내린것 같은데요.	We seem to have landed on a taxiway.
12:16:13	CAP	어, 근데 왜 이렇게 지시를 했지, 활주로가?	Uh, but why is the indication like this, for the runway?
12:16:19	CAP	정말 Taxiway 냐, 이거 ?	Is this really a taxiway ?
12:16:21	F/O	Taxiway 인 것 같습니다.	It looks like a taxiway.
12:16:22	CAP	아~ 이런 개 같은 경우가 있나?	Ah~is there a soiled case like this?
12:16:25	F/O	아유, 어떻게 하다 그리로 갔죠?	Ayoo~how come we went there?
12:16:27	CAP	왜 이렇게, 활주로나 이렇게 지시를 하지?	Why, like this, the runway is indicated like this ?
12:16:33	F/O	저희 Runway 로 빠져야 되겠는데요.	We'd better move into the runway.
12:16:35	CAB	손님 여러분, 이 비행기는	Ladies and gentlemen, this aircraft...
12:16:37	TWR	KE769,	KE769,

Attachment 3 Runway View and HUD Indication Example

12:14:53 A/P ON → OFF



Drift Angle : -7.6deg, Heading : 113.2deg

(The actual indication may differ slightly from this picture shown. The contours of runway and taxiway are not indicated.)

Attachment 4

Reference material: Design Criteria for flight procedure

“Design Criteria for flight procedure” (“Kokukuusei-No.111” dated July 7, 2006) **abstract

Foreword

1.2 This criteria is based on ICAO Doc. 8168 PANS-OPS Vol. II “Construction of Visual and Instrument Flight Procedures”.

Part 4 Arrival and Approach procedures

Chapter 5 Final approach segment

5.2.2 Straight-in approach

5.2.2.2 *Final approach with track not intersecting the extended runway center line.* A final approach which does not intersect the extended center line of the runway may also be established, provided such track lies within 150 m laterally of the extended runway center line at a distance of 1,400 m outward from the runway threshold. However, the inner angle () between the final approach track and the extended runway center line shall be equal to or less than 5 °.(See Figure I-4-5-1)

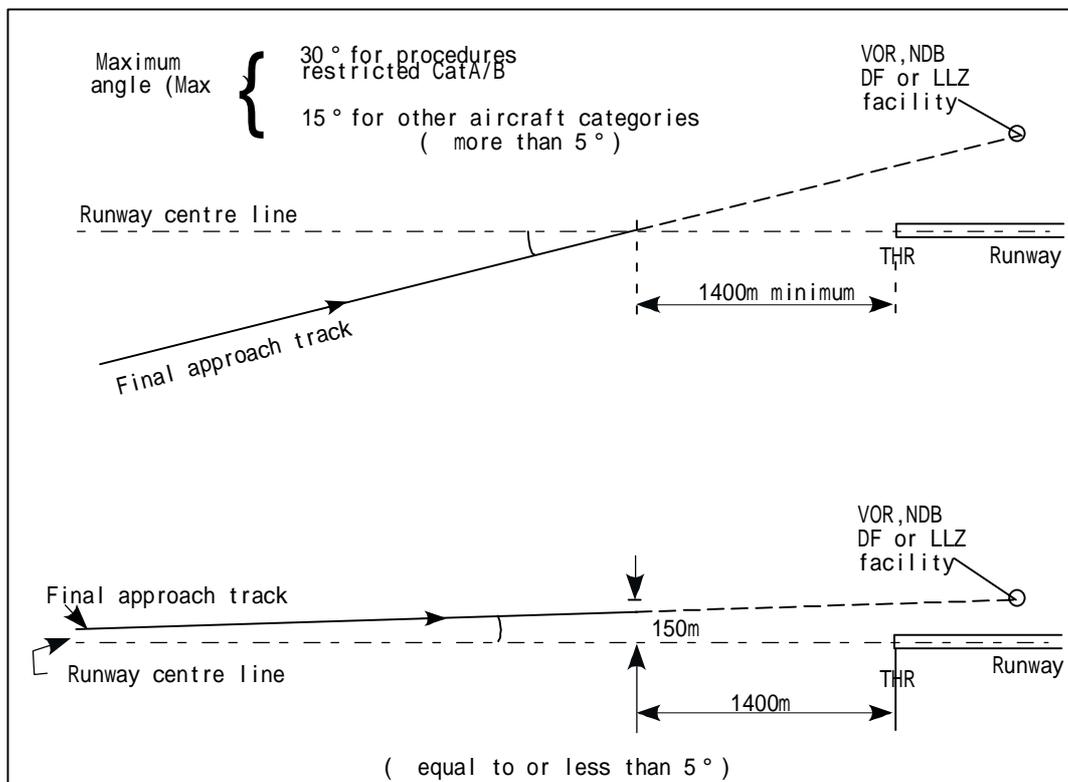


Figure I-4-5-1 Final straight-in approach alignment

ATTACHMENT 5

Comments on the draft final report on the serious incident of the Boeing-737-900 registered HL7724 in Akita Airport (Japan) on Jan 6, 2007.

Concerning the chapter 3.10.. ASSISTANCE OF CONTROLLERS TO AIRCRAFT

ICAO Annex 11(2.2) shows that "Objectives of the air traffic services shall be to provide advice and information useful to the safe and efficient conduct of the flight." In addition, ICAO Doc 4444 ATM/501(7.1.1.2) provides that "Aerodrome controllers shall maintain a continuous watch on all flight operations on and in the vicinity of an aerodrome as well"

However, the tower controller failed to perform his responsibility which he should continuously monitor the approaching aircraft and should provide advice and information useful to guard against unsafe flight conditions. Especially, failure of a go-around instruction to the aircraft which was landing on the taxiway may mean that the controller did not have the ability to immediately cope with the unexpected situation.

Concerning the chapter 3.11. NOTES ON VOR No.1 APPROACH

The VOR DME No.1 RWY 10 chart shows that both final the approach course and missed approach course are identically 105° , and the extension of the final approach course is closer to the taxiway rather than the runway, even though the VOR location is near the runway. Accordingly, it is possible for the flight crew to misunderstand that they are approaching the runway when they approach using the current instrument approach procedure if they do not receive information or do not have experience in approaching this runway.

As a result, we suggest that the related organization needs to express the appropriate information into the instrument approach chart of AXT VOR No.1 Rwy 10 in order for the flight crew or other users to acknowledge the special information prior to flight, like, for example, a special notification included in

Jeppesen JFK ILS DME Rwy 22R.

Concerning the chapter 4. PROBABL R CAUSES

ICAO Annex 11(2.2) prescribes that "Objectives of the air traffic services shall be to provide advice and information useful to the safe and efficient conduct of the flights.", but the tower controller did not instruct a go-around to the aircraft which was approaching and landing on the taxiway even though he had observed the position of the aircraft. Hence, we recommend including the following description.

"In addition, it is considered that the human factor of the controller who did not take safety actions even though he recognized the abnormal situation, was also a contributory factor".

Addition : SAFETY RECOMMENDATION

Civil Aviation Authority

1. To emphasize and give an education to the controllers regarding the importance of the tower controller's right, responsibility and role for preventing an accident or serious incident.
2. To supplement a note to not confuse the runway and taxiway in the instrument approach chart for AXT VOR DME No.1 RWY 10.

Korean Airlines

1. To adopt proper measures to provide the particular information of the AXT VOR DME No.1 RWY 10 approach to all flight crews.

*The actions of this recommendation were already completed Korean Air appended the special notification the related pictures to K-Page 2 and K-Page 5.