Registration No.	
Registration Date	
Handling Agency	The ARAIB

Aircraft Incident Report

Wing-Tip Strike with Building while Taxiing
China Eastern Airlines Flight 5054
A321-211, B2290
West Parallel Taxiway in Daegu International Airport
February 21, 2006

Korea Ministry of Construction and Transportation

Aviation and Railway Accident Investigation Board

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Aviation and Railway Accident Investigation Board

According to the Aviation and Railway Accident Investigation Board Act of the Republic of Korea, Chapter 4, Article 30, it is stipulated;

「**A**ccident investigations shall be conducted separately from any judicial, administrative disposition, administrative lawsuit proceedings associated with civil or criminal liability」

And in Annex 13 to the Convention on International Civil Aviation, Chapter 3, Paragraph 3.1 and Chapter 5, Paragraph 5.4.1, it is stipulated and recommended as follows;

「The sole objective of the investigation of an accident or incident shall be the prevention of accidents and incidents. It is not the purpose of this activity to apportion blame or liability」

「Any judicial or administrative proceedings to apportion blame or liability should be separate from any investigation conducted under the provisions of this Annex」

Thus, based on the Aviation and Railway Accident Investigation Board Act of the Republic of Korea and Annex 13, this incident investigation report, including findings herein, as the result of the investigation effort of China Eastern Airlines Flight 5054, shall not be used for any other purpose than to improve aviation safety.

If conflicts occur on the interpretation of this accident investigation report between the Korean version and English version, the Korean version takes priority over English version.

Aircraft Incident Report

Aviation and Railway Accident Investigation Board, Incident of wing-tip strike with building while taxiing on parallel taxiway, China Eastern Airlines Flight 5054, A321-211, B-2290, Daegu International Airport, Feb. 21, 2006. Aircraft Incident Report ARAIB/AIR F0601. Seoul, Republic of Korea

The Korea Aviation and Railway Accident Investigation Board is an independent government agency established for the purpose of aviation and railway accident and incident investigations. The Board conducts aviation accident and incident investigations in accordance with the provisions of Annex 13 to the Convention on International Civil Aviation and the Korean Aviation and Railway Accident Investigation Board Act. The objective of the Board's investigation into an accident or incident is to prevent accidents and incidents, not to apportion blame or liability. The main office is located near Gimpo International Airport, and the flight recorder analysis and wreckage laboratories are located inside the airport.

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Contents

Aircraft Incident Report

Ⅰ. Title

- Aircraft Operator : China Eastern Airlines
- Aircraft Manufacturer : Airbus Industry, France
- Aircraft Type : A321-211
- State of Aircraft Registry : The People's Republic of China
- Registration : B2290
- Date and Location of Incident : February 21, 2006, around 12:53 (KST[1])
  West Parallel Taxiway of Daegu International Airport

Ⅱ. Executive Summary

On February 21, 2006, about 12:53, China Eastern flight 5054 aircraft(Aircraft 5054 hereinafter), an Airbus A321-211, Registration B2290, operated by China Eastern Airlines, was departing from Daegu International Airport, korea(Daegu Airport hereinafter)bound for Pudong International Airport, China(Pudong Airport hereinafter), and was taxiing on a west parallel taxiway toward the take off runway 31R. In the course of taxiing, the aircraft was moving straight ahead along the erased centerline on the taxiway not in use, instead of following the yellow centerline[2] on the newly constructed curved taxiway, and the left wing tip of the aircraft struck the eaves of PAR Site nearby, which resulted in the damage to the left wing tip and wing tip fence.

China Eastern Airlines has been operating 7 international passenger flights per week[3] between Pudong Airport and Daegu Airport, and on the incident day, one Captain, one First Officer, one Maintenance Engineer, 8 cabin crew and 155 passengers were on board Aircraft 5054, and there were no injuries to persons sustained by this incident.

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[1] KST(Korea Standard Time) : Unless otherwise indicated, all hours appeared in this report are based on KST on 24 hours basis.

[2] A section of the west taxiway was changed to a curved taxiway, and accordingly a new yellow centerline was marked on it.

[3] China Eastern Airlines is operating flights CES5053/CES5054 (regularly scheduled/5 flights a week) and CES5029 /CES5030 (Non-scheduled/2 flights a week) between Pudong Airport/ Daegu Airport.

Upon notification of the incident, the Aviation and Railway Accident Investigation Board[4](ARAIB hereinafter) investigators initiated and conducted the on-scene investigation in Daegu Airport jointly with the competent airport authority(ROKAF), and the International Civil Aviation Organization (ICAO) and the accident investigation agencies of the relevant States were notified of the incident, in accordance with Annex 13 to the Convention on International Civil Aviation.

During the on-scene investigation phase, one urgent safety recommendation was made to the Civil Aviation Safety Authority, and another recommendations to the pertinent organizations for the immediate implementation of the taxiway marking supplementation to the curved taxiway and its inclusion in the AIP.

The analysis of this incident to Aircraft 5054 included examinations of issues related to general, the incident sequence, flight crew performance, aerodrome facilities, aeronautical information services and air traffic control services, and the ARAIB developed the findings related to probable causes derived from the factual information and analysis of Aircraft 5054 incident as follows:

1. While taxiing, the flight crew did not fully perform “Pilot’s obligation for caution” such as being negligent in watching for all directions and verifying ground markings.

2. The following factors constituted a chain of event and contributed to the errors made by the flight crew of Aircraft 5054:
   - The flight crew were taxiing without knowing the information on the curved taxiway and obstacles (PAR building);
   - The control tower’s “Taxi straight ahead” instruction to Aircraft 5054 when the aircraft entered the parallel taxiway where the curved taxiway was located;
   - Non-installation of a taxiway edge marking which would enable the flight crew to recognize the pavement surface not to be used by aircraft.

On the basis of the factual information, analysis and conclusions as such, the ARAIB developed safety recommendations to China Eastern Airlines(1 item), Busan Regional Aviation Administration (2 items), ROKAF(3 items), Korea Airports Corporation(1 item) and Korean Airlines (1 item).

[4] In accordance with the enforcement of the "Law concerning Aviation and Railway Accident Investigation" on July 9 2006, the “Aviation Accident Investigation Board” and “Railway Accident Investigation Board” were consolidated and "Aviation and Railway Accident Investigation Board" was established on July 10, 2006.

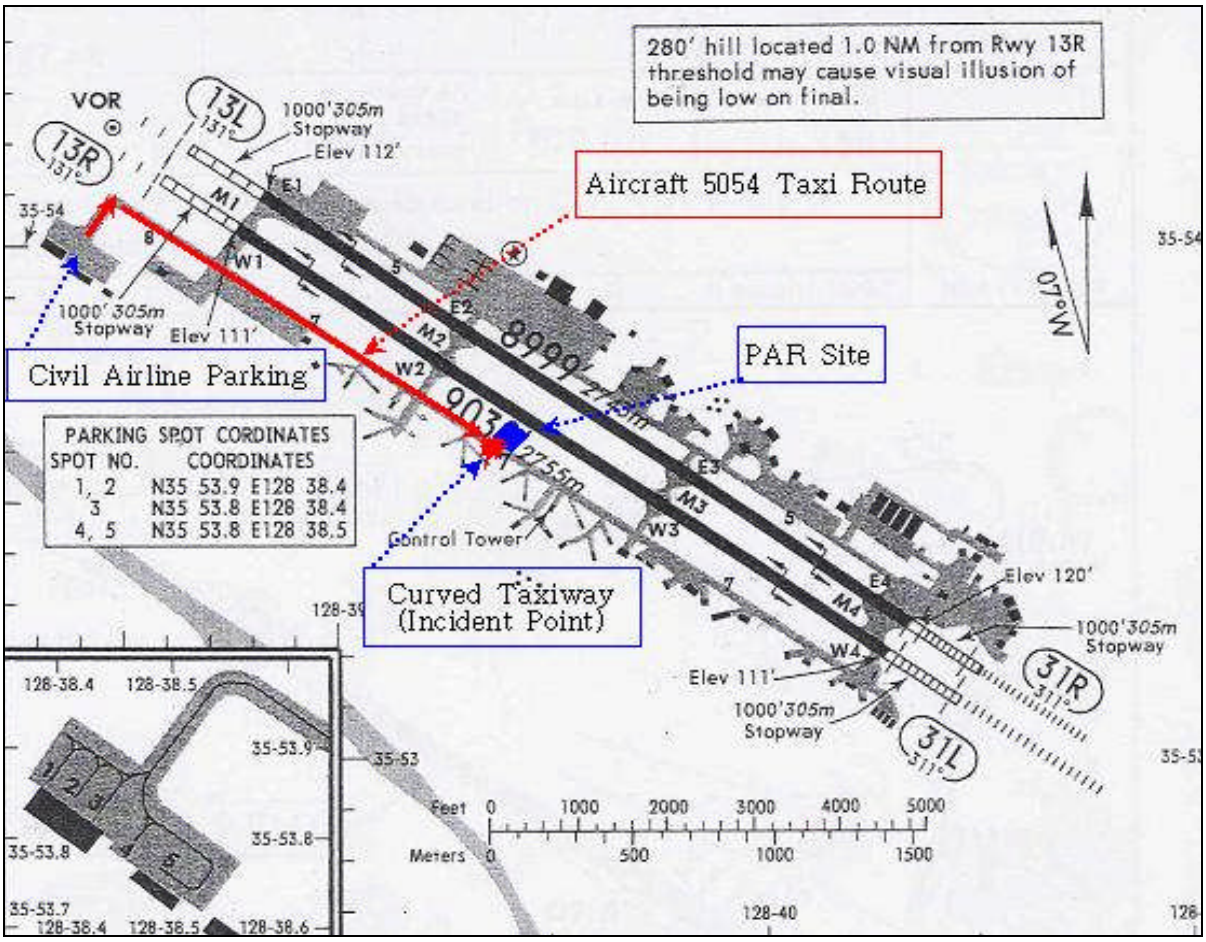
Ⅲ. Body

1. Factual Information

1.1 History of Flight

Aircraft 5054 landed at Daegu Airport at 11:42 on February 21, 2006 as flight CES5053, and arrived at the terminal gate at 11:47. Afterward, the aircraft completed the preparation for another departure, and was pushed back as Flight CES5054 at 12:44.

After Aircraft 5054 was given taxi clearance from Daegu Control Tower at 12:47, the Aircraft started taxiing along the west parallel taxiway in order to move to runway 31R for take-off.
(Refer to Figure 1)



[Figure 1] Aerodrome Chart of Daegu Airport

At around 12:53, Aircraft 5054 was taxiing on the west parallel taxiway but was going straight ahead along the erased centerline on the taxiway not in use instead of going along the yellow centerline on the newly constructed curved taxiway. At that time, the wing tip and wing tip fence of the aircraft struck the eave of PAR Site nearby.

Due to this incident, the left wing tip and wing tip fence[5]of Aircraft 5054 had impact damage, but there were no injuries to persons.

All the passengers and the flight attendants on board Aircraft 5054 departed from Daegu Airport at 20:50 on the day of the incident using the substitute aircraft provided by China Eastern Airlines, and the aircraft received the technical approval and the Special Flight Permission from the General Administration of Civil Aviation of China after completing the works based on CDL[6] , and returned on ferry flight with the Captain, the First Officer and the Maintenance Engineer on board around 13:04 on February 23, 2006.

1.2 Injuries to Persons

There was no injury to persons related to this incident.

1.3 Damage to Aircraft

In the process of the contact of the left Wing Tip and Wing Tip Fence of Aircraft 5054 with the eave of PAR Site of Daegu Airport, left Wing Tip and Wing Tip Fence was damaged as shown in the [Picture 1] but after the engineers specialized in airframe who were dispatched by China Eastern Airlines took necessary actions based on the technical approval of the manufacturer and CDL 6.01.57 P 01 as shown in the [Picture 2], the aircraft received the Special Flight Permission from the General Administration of Civil Aviation of China and departed Daegu Airport at 13:04 on February 23, 2006.

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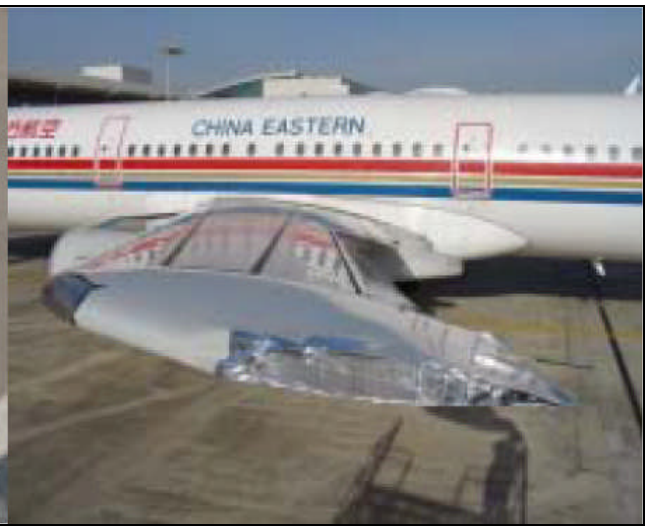
[5] Wing Tip & Wing Tip Fence
[6] CDL : Configuration Deviation List

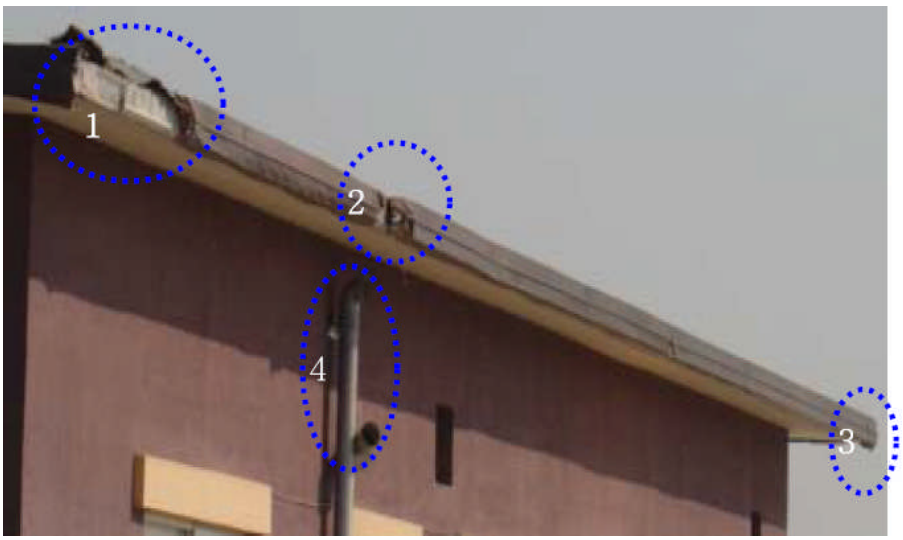
[Picture 1] Picture of damaged left Wing Tip



[Picture 2] Picture after the completion of works

1.4 Other Damage

As the left Wing Tip and Wing Tip Fence of Aircraft 5054 contacted PAR Site, 3 places[7] of roof covered with copper plate and the upper part of ventilation pipe affixed to wall were damaged as shown in the [Picture 3] and there was a trace of scratch under the eave.



[Picture 3] Damaged Parts of PAR Site

[7] Level of roof damage : 1. Transverse 1.8m, Perpendicular 20cm, 2. Transverse 50cm, Perpendicular 20cm, 3. State of being pulled back upward, 4. Upper part of ventilation pipe

1.5 Personnel Information

1.5.1 The Captain

The Captain (34 years old) joined the company in June 1992 and was promoted to the Captain of BAe-146 in 1995 and to the Captain of A320 in 1999, and held an Airline Transport Pilot License issued by the CAAC, Class 1 of Medical Certificate (Examination on December 5, 2005), Temporary Flight Instructor License (January 11, 2006 ~ May 10, 2006) and English Certificate for Flight crew[8] which were all valid.

According to the data provided by the General Administration of Civil Aviation of China/CAAC, total flight hours of the Captain was 10,763 hours, flight hours for A320/321 was 5,567 hours, PIC Time on Type was 4,500 hours and the flight hours for the latest 3 months was 210 hours. The Captain received regular Recurrent Training and Proficiency Check in September 2005 and obtained A320 Instructor Training Certificate in December 2005.

The Captain's flight experience to Daegu Airport was the second time after November 2005, and all experiences with the Flight CES5053 and 5054 were the performance of the Supervisor and First Officer including radio communication at the right seat (the First Officer seat). And the Captain stated that for the period from the flight of the day back to 24 hours, he did not take liquor or medicines which were prohibited, and general health condition was in a normal state.

1.5.2 The First Officer

The First Officer (31 years old) joined the company in July 1998 and has been assuming the position of the First Officer of A320/321 and held Commercial Pilot License, Class 1 of Medical Certificate (Examination on November 22, 2005) and English Certificate for Flight crew[9] which were all valid.

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[8] CNWA Gangsu Branch issued it, which certifies the pass of Test of Professional Aviation English.

[9] Eastern Shanghai Flight Team issued and certifies the pass in Simulated Test of Radio Telephony Communication English and Test of Professional Aviation English.

According to the data provided by the General Administration of Civil Aviation of China/CAAC, total flight hours of the First Officer was 4,592 hours, flight hours for A320/321 was 1,748 hours and flight hours for latest 3 months was 113 hours. The First Officer received regular Recurrent Training and Proficiency Check in January 2006.

The First Officer's flight experience to Daegu Airport was total 10 times including one time in December 2005, and the First Officer stated that for the period from the flight of the day back to 24 hours, he did not take liquor or medicines which were prohibited, and general health condition was in a normal state. And the First Officer stated that during the flights of CES5053 and 5054 on the day of incident he performed PF at the left seat (the Captain seat) for both flights.

1.5.3 The Maintenance Engineer on Board

The Maintenance Engineer on board joined the company in July 1991 and was maintaining the qualification for the maintenance of the aircraft type of A319/320/321 and A340-300.

As same as most other airline companies, China Eastern Airlines has been arranging its Maintenance Engineer to get on board the aircraft directly in the case of the international flights flying to the airports where its Maintenance Engineer is not resident there and to assume maintenance supports[10], and in this regard the said Maintenance Engineer got on board the flight of CES5053 and 5054 on the day for this mission. At the moment of the incident the Engineer was positioned at the Observer Seat in the cockpit.

1.5.4 The Air Traffic Controller

While Aircraft 5054 was taxiing from gate to the Incident Point, the Ground Controller (29 years old) of Daegu Control Tower was performing the ground control services. He obtained Ground Control Qualification for Daegu Control Tower[11], Local Control Qualification[12] and Air Traffic Controller level II Skill[13], and he also possessed Air Traffic Controller Certificate[14] under the provision of the Article 25 of the Aviation Act.

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[10] to do the line maintenance and to release the aircraft
[11] Obtained on September 29, 1997
[12] Obtained on April 2, 1998
[13] Obtained on August 12, 2003
[14] Obtained on August 30, 2005

1.6 Aircraft Information

1.6.1 History of Aircraft

The type of aircraft is A321-211 (Serial No. for manufacturing: 2315), and it was manufactured by Airbus Industry on October 26, 2004 and has been operated by China Eastern Airlines up to incident time.

It was confirmed that total flight hours of the aircraft was 3,615 hours with total 2,027 times of landing, and the result of review of flight and maintenance records of the aircraft showed nothing particular.

1.6.2 Weight and Balance

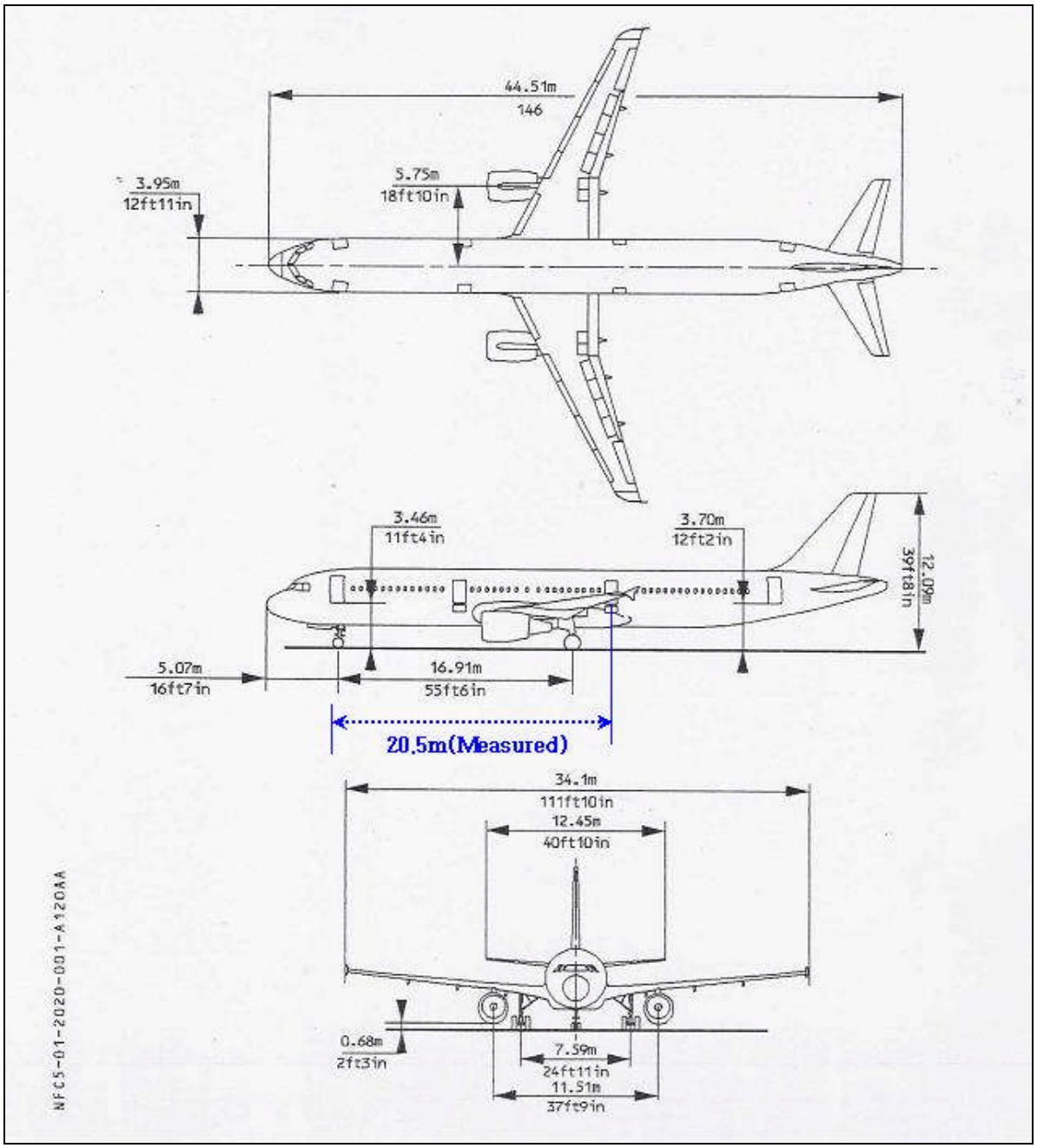
The result of comparison of actual weight and maximum authorized weight of Aircraft 5054 showed sufficient extra capacity, and loaded fuel was at appropriate level for the flight between Daegu Airport and Pudong Airport while TOW C.G % MAC was 30.8 which was within the marginal value.

Detailed weight data are as follows.

- ZFW(Zero Fuel Weight) ..... 62,792 kg(Max. 73,800 kg)
- TOF(Take off Fuel) .....……..... 9,800 kg
- TIF(Trip Fuel) .....……..... 5,800 kg
- TOW(Take off Weight) .....…..... 72,592 kg(Max. 93,000 kg)
- LDW(Landing Weight) .....…..... 66,792 kg(Max. 77,800 kg)
- Pay Load .....…….. 12,892 kg

1.6.3 Principal Dimension

According to A321 FCOM (Flight Crew Operating Manual) and actual measurement data, principal dimension is as shown in the [Figure 2].



[Figure 2] The Principal Dimension of Aircraft A321

1.7 Meteorological Information

According to the meteorological information which the flight crew of Aircraft 5054 received from the person in charge of flight who is a staff of Korean Airlines, local support Airlines for Daegu Airport, the visibility of Daegu Airport at that time was good, and the tower controller who performed ground control for Aircraft 5054 stated that the visibility was as good as he could clearly see the taxiing of Aircraft 5054 from the control tower.

METAR of Daegu airport before or after the time of occurrence of the incident is as follows:

(12:00 Weather)
METAR RKTN 210300Z 29004 KT 9000[15] SKC 11/M05 Q1023 NOSIC

(13:00 Weather)
METAR RKTN 210400Z 33004 KT 9000 SKC 12/M07 Q1021 NOSIC

1.8 Aids to Navigation

Aircraft 5054 did not use Aids to Navigation while taxiing.

1.9 Communications

According to the air traffic control recording of Daegu Control Tower and cockpit voice recording, radio communication between Daegu Control Tower and Aircraft 5054 was established with 118.2 MHz while the aircraft was taxiing, and there was no problem for communication.

1.10 Aerodrome Information

1.10.1 General

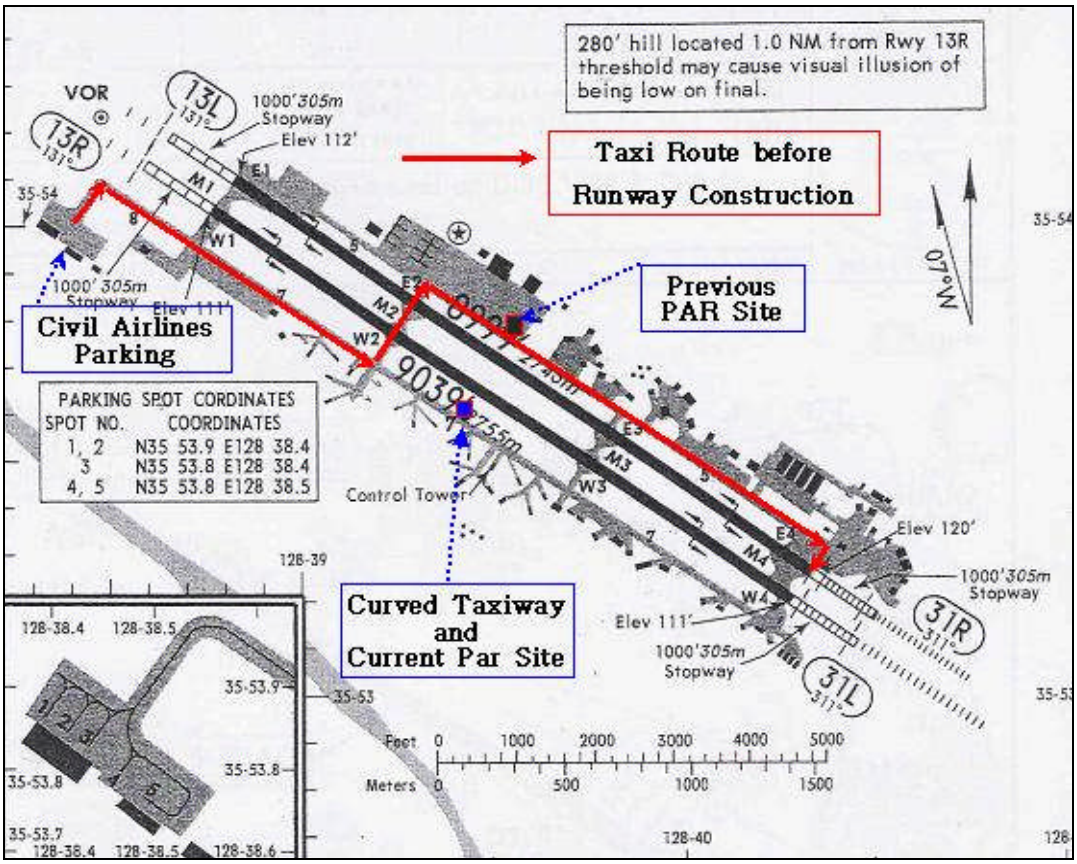
Daegu Airport is an airport which uses military aerodrome and is operated under the control and supervision of military authority. Civil aviation is being operated based on “Agreement for the Use of Airport entered into between the Minister of Defense and the Minister of Construction and

[15] Visibility 9 km

Transportation," and currently the airport is being operated as an international airport with 160 domestic flights per week and 54 international flights per week.

For the implementation of re-pavement work for main runway (RWY 31L-13R), Daegu Aerodrome Authority had to use preliminary runway (RWY 31R-13L) and for this the Authority moved and installed the PAR Site which used to be located near the preliminary runway to current location[16].

However, the moved and installed site was also located near west parallel taxiway and became an obstacle for civil flights. Therefore all civil aircrafts were required to cross the runway through the taxiway W2, M2 and E2 as shown in the [Figure 3] and then to use east parallel taxiway (TWY 5).

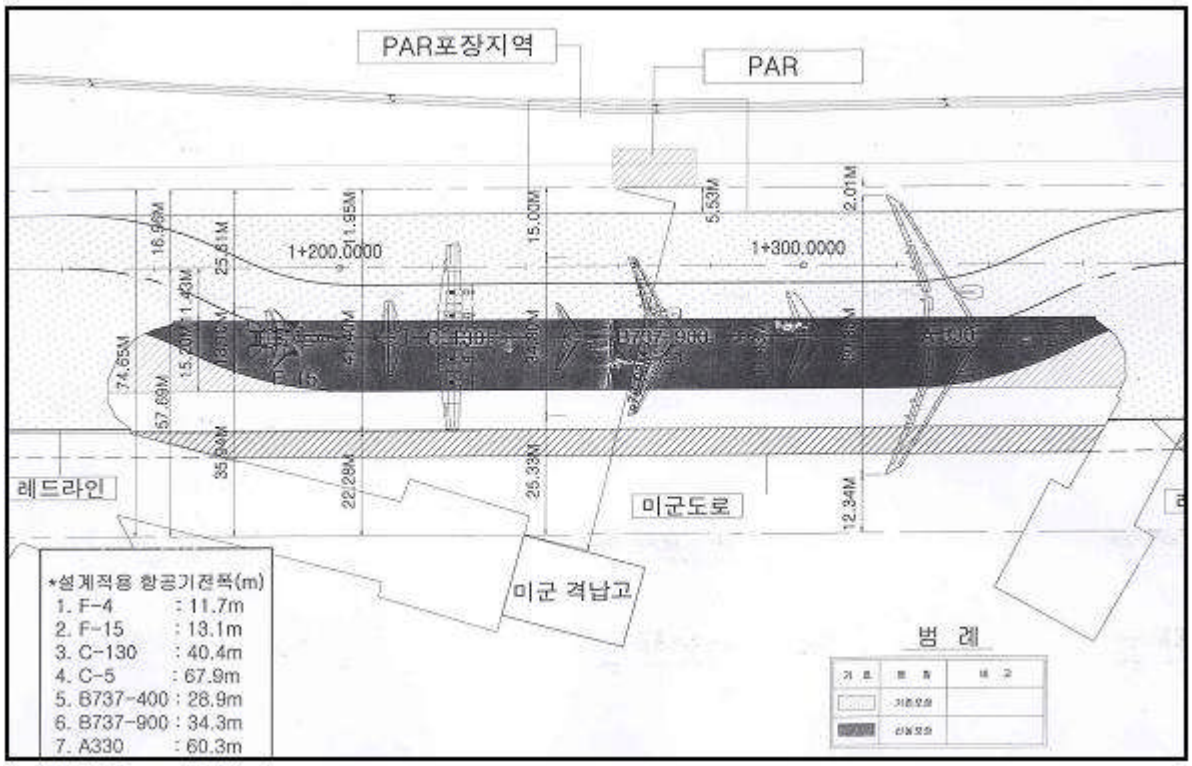


[Figure 3] Aerodrome Chart of Daegu Airport

[16] In consideration of equipment capacity and space availability, current site was selected in accordance with the Military Aviation Facility Installation Standard and the site has been used from May 2004 after the moving and installation

1.10.2 Curved Taxiway on TWY 7

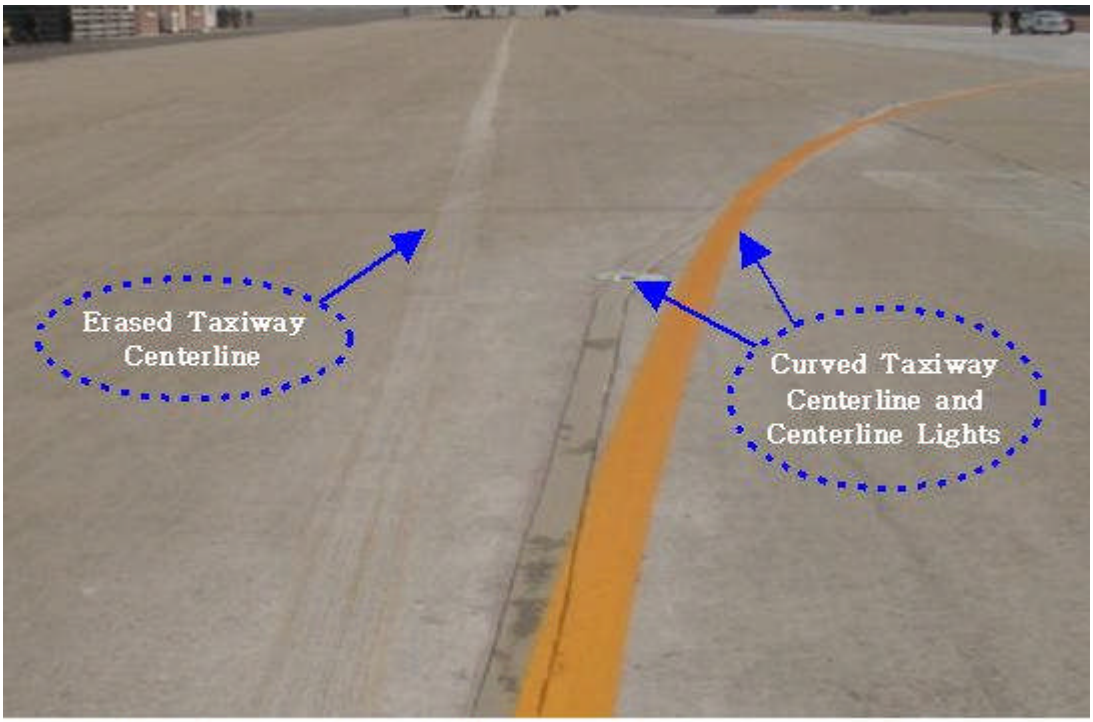
In order to improve the efficiency of civil aircraft operation and to implement the dust-proof pavement[17] work plan for east parallel taxiway, the need for the operation of west parallel taxiway was arisen and therefore Aerodrome Administration Authority expanded a part of the taxiway in front of PAR Site as shown in the [Figure 4] toward west side and constructed curved taxiway[18], which has been used by 50 flights of civil aircrafts for the period from the opening of the taxiway on February 18, 2006 (3 day before the occurrence of the incident) up to the time of incident.



[Figure 4] Curved Taxiway in front of PAR Site

At the time of the incident, the yellow color of the centerline which was indicated as yellow solid line on the existing straight taxiway was erased using concrete scratching off method as shown in the [Picture 4] but the erased portion was not turned into the color of other pavement surface and therefore the trace was still remaining in the form of white solid line.

[17] Taxiway shoulder pavement work
[18] Designed on the basis of safety distance which enables ground taxiing of the aircrafts below B737-900 type



[Picture 4] Trace of existing straight Taxiway Centerline and newly installed curved Taxiway Centerline

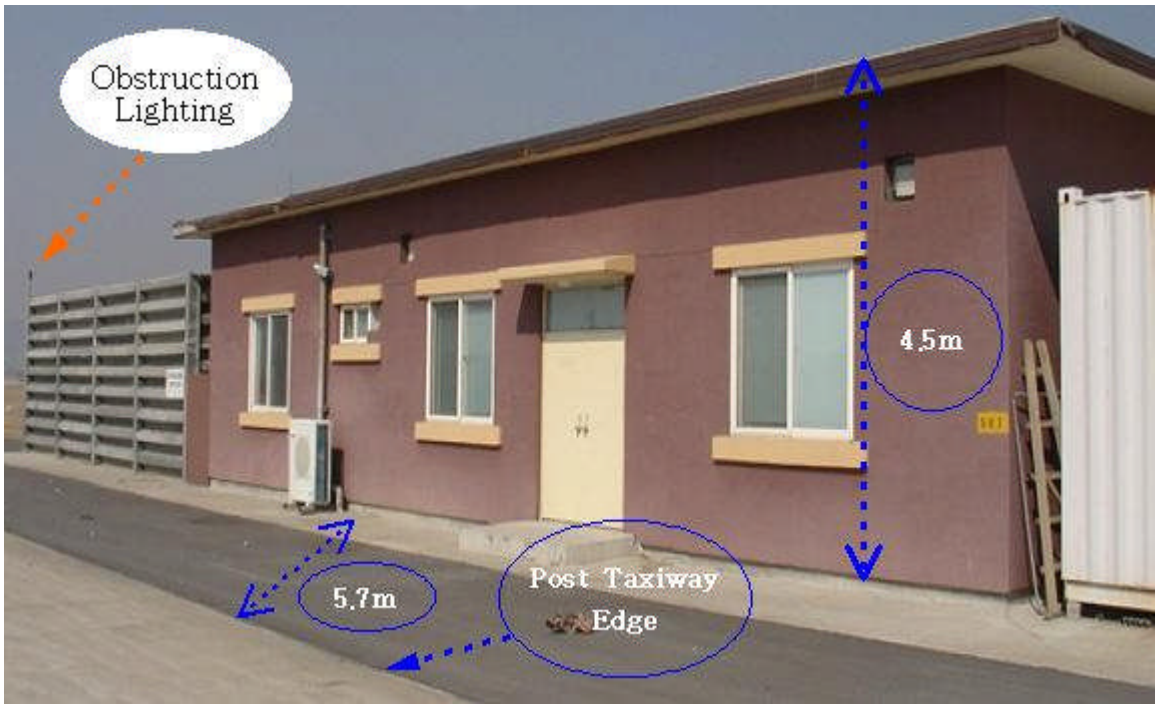
According to the Standard[19] on Airport Marking in the Advisory Circular[20]of Federal Aviation Administration, the markings on the pavement surface which is no longer necessary should be completely eliminated using the spraying of sands, chemical method or other method so that the possibility of pilots' misunderstanding should be eliminated. In the "Aerodrome Painting (Gonggyu 9-27)" of ROKAF regulation, there was no stipulation on the detailed method for the elimination of markings on the pavement surface.

On the Curved Taxiway,[21] Taxiway Centerline Markings painted with solid yellow line in the width of 15cm and Taxiway Centerline Lights were installed but along the curved Taxiway there were no Taxiway Edge Lights, Taxiway Edge Markings, Taxi Shoulder Markings and Surface Painted Taxiway Direction Signs installed.

[19] d of item 3 of Section 1
[20] AC Number: 150/5340-1H
[21] Radius of curve 78.8m, Cross angle with straight Taxiway 15°

1.10.3 Obstruction Lighting

PAR Site and PAR Antenna protection wall located near the edge[22] of west parallel Taxiway was located at a place which is 37.3m away from the curved Taxiway Centerline and 12m away from the straight Taxiway Centerline with one set of Obstruction Lighting as shown in the [Picture 5].



[Picture 5] Obstruction Lighting

1.10.4 Aeronautical Information Services

The Annex 15 of the Convention on International Civil Aviation stipulates that aeronautical information is the information which is necessary for safety, rules and efficiency of air navigation and is required to be informed to the flight crew and Air Traffic Service Agencies in an accurate and timely manner.

[22] Edge of Pavement surface of the existing straight Taxiway

Under the provisions of the Article 73 of the Aviation Act and the item 1 and 4 of the Article 216 of the Enforcement Rule of the said Act, PAR Site was constructed near west parallel taxiway and therefore the change in the taxiway from the existing straight taxiway to curved taxiway is a major change in the part of aerodrome and therefore the information is aeronautical information which should be provided to the crews of aircrafts for the safety of air navigation in accordance with the pertinent procedure.

Under the Aeronautical Information Service Regulation[23], the Aeronautical Information Service organization for Daegu Airport is Busan Regional Aviation Administration, and the regulation stipulates that the Aeronautical Information Service organization should compile information from "other available sources."

1.10.4.1 NOTAM

There was no distribution in the form of NOTAM about the fact of the change in west parallel taxiway of Daegu Airport to curved Taxiway.

The Flight Information Service Regulation[24] of ROKAF stipulates that dispatch service of NOTAM of Daegu Airbase should be managed by ROKAF and the information about all airport facilities recorded in the flight information publications should be always accurate while transmitting the information on new items which were not recorded in the flight information publications to all the authorities concerned immediately in case it is acknowledged that the new information needs to be urgently spread out. The Regulation also stipulates that the items requiring urgent handling may be informed to the inbound and outbound pilots by radio through Air Traffic Control Agency concerned.

The Regulation further stipulates that the information about the "Airport facilities which creates restraints or becomes an obstacle to the operation of aircraft" and the information about the "Ground obstacle which affects the operation of aircraft" as one of the items which may be notified in the form of NOTAM On the other hand, the Regulation specifies that the "Information related to Taxiway, Gate, Apron and Stopway" are the items which cannot be notified as NOTAM. Even though any item is not subject to the notification as NOTAM but the information which is judged to

[23] The Ministry of Construction and Transportation, Civil Aviation Safety Authority Announcement No. 2005-39
[24] ROKAF Manual 5-343/Operation

be the item which the Flight crew should be familiar with should be notified to all department concerned within the Airbase in the form of Airman's Advisory[25].

Aeronautical Information Service Regulation of the Ministry of Construction and Transportation and the Annex 15 to the Convention on International Civil Aviation[26] stipulate that in case there is information about permanent change but there is not enough time to correct in the form of Aeronautical Information Publications, NOTAM should be promptly issued.

The Regulation and the Annex also stipulates that "Material change in the operation of aerodrome" is the item for which NOTAM should be issued whereas "Ordinary repairing work of the apron and taxiway which do not affect safe moving of aircrafts" is the item which cannot be announced as NOTAM.

1.10.4.2 Aeronautical Information Publication (AIP)

Pertinent regulations[27] stipulate that AIP is basically essential for air navigation, permanent information is included in AIP and Aerodrome Chart and Aerodrome Ground Movement Chart are also included in the AIP or those are separately distributed to the recipients of AIP.

The change of west parallel taxiway of Daegu Airport to curved taxiway was not published in the supplement of Aeronautical Information Publications, and Jeppesen's Aerodrome Chart of Daegu Airport which the Flight crew of Aircraft 5054 possessed and used at the time of occurrence of incident is as per [Figure 5] and the Aerodrome Chart of Daegu Airport in the Aeronautical Information Publication which was valid at that time is as per [Figure 6].

In the Flight Information Publications issued by ROKAF, the change of west parallel taxiway of Daegu Airport to curved taxiway was not mentioned either.

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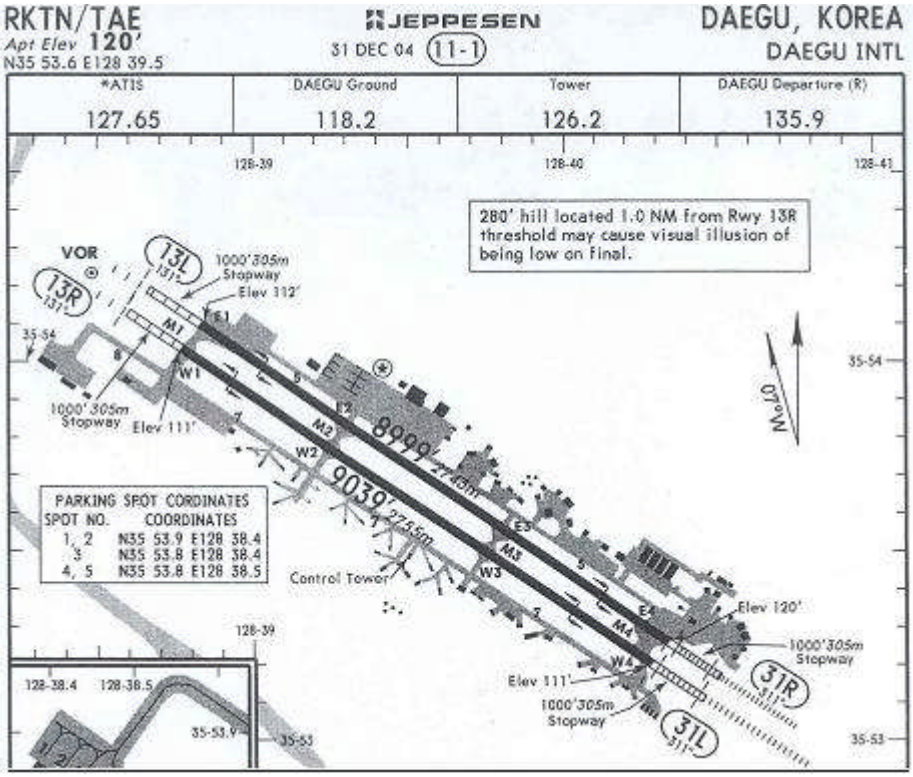
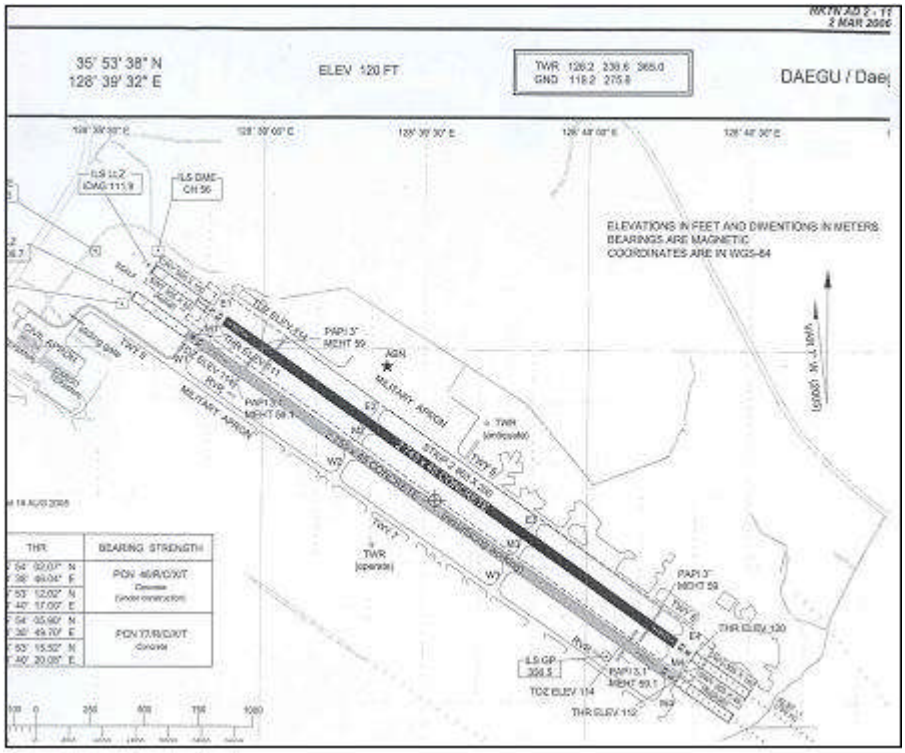
[25] This is a form of informing aviation information to Airmen and various methods are allowed for this. This is not in the form of NOTAM telegram

[26] The contents are almost same as that of Aviation Information Service Regulation

[27] Chapter 4 of the Annex 15 to the Convention on International Civil Aviation and Chapter 4 of the Aviation Information Service Regulation of the Ministry of Construction and Transportation



[Figure 5] Jeppesen's Daegu Aerodrome Chart used by the flight crew of Aircraft 5054



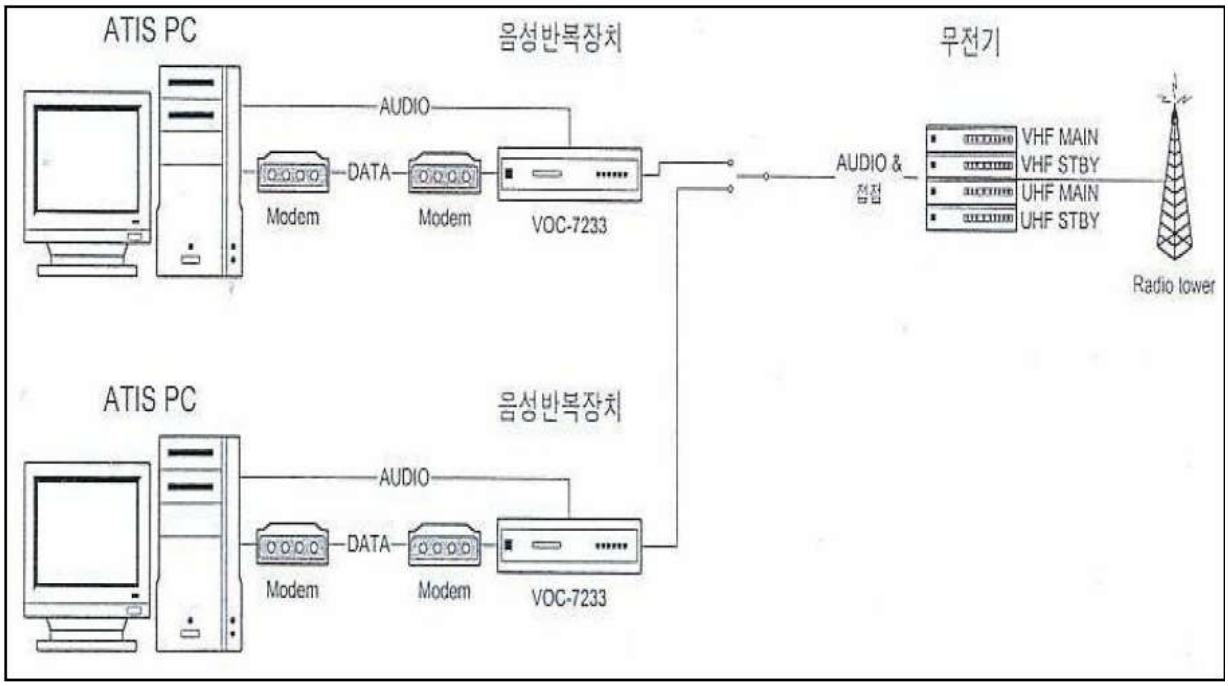
[Figure 6] Daegu Aerodrome Chart on the AIP at the time of the incident

1.10.4.3. Automatic Terminal Information Service (ATIS)

ATIS is automatic repeated broadcasting system to provide essential and ordinary aerodrome information to the Crews of aircrafts for the purpose of the enhancement of service efficiency of Air Traffic Controller and the reduction of frequency congestion.

At the time of the incident, information on the curved part of west parallel Taxiway and PAR was not input to ATIS[28] of Daegu Airport and therefore information in that regard was not broadcasted.

Block diagram of ATIS System of Daegu Airport is as per [Figure 7]. When the Controller selects certain information which was already stored in computer as voice information, the information is edited in the form of ATIS broadcasting format and the System automatically repeats the broadcasting of the information. For this reason, only the information stored in the computer can be broadcasted and under this System, the contents of broadcasting could not be changed at any time depending on the judgment of the Controller.



[Figure 7] Block Diagram of ATIS System of Daegu Airport

[28] It was installed in Daegu Access Control Tower on November 20, 1999. Program was revised on October 13, 2003 and has been operated up until the occurrence of the incident. The subject of operation of the System was ROKAF and its maintenance was done by Korea Airports Corporation

1.10.5 Propagation to the Flight Crew

Aerodrome Administration Authority propagated the information on the change of the some section of west parallel taxiway of Daegu Airport to curved Taxiway and its installation through the meeting with Construction officers concerned but did not propagated in the form of documents based on Aeronautical Information Propagation System.[29] A Civil Tower Controller who was a staff of Daegu Airport Representative Office of Busan Regional Aviation Administration and was working at Daegu Control Tower perceived the information about the installation of the curved taxiway and the procedure for use through the meetings for 7 times[30] including the meeting related to the implementation of Daegu Airport Runway Re-pavement Work held on June 28, 2005.

The said Civil Tower Controller who perceived the information about the curved taxiway did not informed the information to Aeronautical Information Service Agency such as Flight Information Office of Daegu Airport Representative Office as aeronautical information while informing the information to the staff in charge of flight in Daegu Airport from Korean Airlines and Asiana Airlines for 7 times[31] verbally or in the form of informal document.

The staff in charge of flight in Daegu Airport from Korean Airlines which entered into the contract for flight operations support with China Eastern Airlines has never provided the information about the curved taxiway to the Flight crew of Aircraft 5054.

1.10.6 Air Traffic Control Services

1.10.6.1 The Authority of ATC

Aerodrome Control Service which was performed at the Daegu Airport Control Tower has been handled by ROKAF, and at the time of the occurrence of the incident 5 Controllers from ROKAF and 1 Civil Controller from Daegu Airport Representative Office of Busan Regional Aviation Administration were assigned[32] to the Control Tower based on the Article 3 of the pertinent Agreement[33].

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[29] Aviation Information compilation and propagation system for the purpose of the issuance of NOTAM or the recording on Aviation Information publications

[30] Meetings held on June 28, 2005, July 5, 2005, Sept. 8, 2005, Feb. 10, 2006, Feb. 12, 2006, Feb. 13, 2006 and Feb. 18, 2006

[31] Notification of the meeting result after the participations in the meetings referred to in the Note 22

[32] Permanently stationed in the Control Tower from the 1st flight of civil aircrafts to the completion of final flight (including off duty days)

[33] Agreement on the Use of Daegu Airbase by Civil Aircrafts (March 2000, Article 3)

According to the statement of the Civil Controller, in the morning of the day he visited the office of the construction company for pavement work of Daegu Airport in order to compile accurate data about the taxiway[34]. While he was in the Flight Information Office for his personal reason after lunch, he received the information on the incident from the Team Leader of Control Tower at around 12:56 and went to the incident site. At the moment of the occurrence of incident, he was not in the Control Tower.

Ground Control for Aircraft 5054 was performed by the tower controller sitting on the Ground Control seat who has the qualification for aerodrome control service of Daegu Control Tower for the period starting from Gate to the time of strike with PAR Site, and Ground Control after the strike was performed by the team leader[35] at that time.

1.10.6.2 History of Ground Control

According to the transcript of Cockpit Voice Recorder mounted on Aircraft 5054, at 12:47:45 the Flight Crew of Aircraft 5054 which was parked at a Gate of Daegu Airport requested Taxi Clearance to Daegu Control Tower using the frequency of 118.2MHz saying “Daegu Ground, China Eastern 5054 ready to taxi” and at 12:47:51 Ground Controller issued clearance saying “China Eastern 5054 taxi to Runway 31 right, altimeter 3016”. At 12:47:58 hour, for the permit, the flight crew of Aircraft 5054 read back saying “Taxi to the 31 right, QNH 3016, China Eastern 5054.”

When Aircraft 5054 was taxiing[36] on the Taxiway 8 at 12:50:11, Ground Controller instructed saying “China Eastern 5054, taxi straight ahead until whiskey four” and at 12:50:16, for this instruction, the flight crew of Aircraft 5054 read back saying “Straight ahead until whiskey four, China Eastern 5054.”

At 12:53:09, when Aircraft 5054 was right in front of the starting point of the curved taxiway after passing taxiway W2 from taxiway 7[37], the Ground Controller instructed saying “China Eastern 5054, Follow yellow line” and at 12:53:13, for this instruction, the flight crew of Aircraft 5054 read back saying “Roger, follow yellow line, China Eastern 5054.”

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[34] Taxiway 7 and Taxiway 4
[35] Also in charge of Supervisor of Control Tower
[36] Ground Controller is stating the position of the Aircraft looking at the Aerodrome Chart in AIP
[37] Position based on the statement of Ground Controller

At 12:53:17 there was a sound of strike and at 12:53:50, the Ground Controller instructed right after Aircraft 5054 passed PAR Site saying “China Eastern 5054, Hold in position.” At 12:53:53 , for the instruction, the flight crew of Aircraft 5054 read back saying “Hold position, Roger.”

At 12:53:58, Ground Controller called Aircraft 5054 saying “China Eastern 5054, Ground” and at 12:54:00, the flight crew responded saying “Roger, Hold position.” At 12:54:02, the Ground Controller instructed for reconfirmation saying “Roger, we have some problem, hold in position” and at 12:54:05, for this instruction, the flight crew of Aircraft 5054 responded saying “Roger, hold position on yellow line.”

1.11 Flight Recorders

1.11.1 Flight Data Recorder

SSFDR, which was manufactured by Honeywell and is available for 25 hours recording was mounted in the aircraft. The ARAIB took out the equipment from the Aircraft, extracted and decoded the volume of data for 25 hours, and used the data covering from the time when the aircraft started taxiing to the time when wing tip and wing tip fence was contacted the building for the investigation of this incident.

According to the data from FDR, the Aircraft maintained the speed of 23-24 knots for the period after the Aircraft entered west parallel taxiway up until its wing tip and wing tip fence contacted with the building while the speed of the moment when the aircraft contacted with the building was 24 knots.

According to [Figure 8], the time when Daegu Control Tower instructed the flight crew to “Follow yellow line” was at the 94 m front point from the occurrence point of the incident and the point where the flight crew started to respond to the instruction was 43 m front point. And simultaneously with the pilot’s reading back, the sound of contact was generated.[38]

[38] The time when the Pilot completed reading back and the time when the sound of contact was heard was the same time.

UTC FDR	CVR시간	대화시작 거리-D	대화끝 거리-D	M/초		대화 시작시간	대화 끝난시간	소요시간	CVR녹취	HDG deg	GS kts	VHF1
	01:14:30	94	63	12.3	7.60	01:14:30.0	01:14:32.5	00:00:02.5	China Eastern 5054, Follow yellow line	130.8	24	NOT
3:53:11	01:14:31	0		12.3						130.4	24	NOT
	01:14:32	0		12.3						130.4	24	NOT
	01:14:33	48	0	12.3	3.90	01:14:33.7	01:14:37.6	00:00:03.9	Roger, follow yellow line China Eastern 5054	130.4	24	XMIT
	01:14:34	0		12.3						130.4	24	XMIT
3:53:15	01:14:35	0		12.3						130.4	24	XMIT
	01:14:36	0		12.3						130.4	24	XMIT
	01:14:37	0		0.0	0.00	01:14:37.6	01:14:37.6		[Impact Sound 쿵!]	130.4	24	NOT
	01:14:38					01:14:38.1			Uh! Yo! [Surprising exclamation]	130.4	24	NOT
3:53:19	01:14:39									130.4	24	NOT
	01:14:40					01:14:40.0			//??? 중국어//	130.1	22	NOT
	01:14:41									130.4	14	NOT
										130.4	10	NOT
3:53:23										130.8	8	NOT
										130.8	6	NOT
										130.8	3	NOT

* Distance (D) is from the left Wing Tip to PAR Site (Accessible side) expressed in metric unit

[Figure 8] FDR & CVR Data

1.11.2 Cockpit Voice Recorder

In the Aircraft, SSCVR which was manufactured by Honeywell and is available for recording for 120 minutes was mounted.

The ARAIB took out the equipment from the Aircraft, prepared the Transcript for the period from the time when the Aircraft started taxiing to the time when Wing Tip contacted with the Building through the data extracted from Mixed Channel[39], translated the Transcript into 3 languages of Korean, Chinese and English through the technical meeting with the investigation officers of the General Administration of Civil Aviation of China/CAAC and at the same time confirmed that the translation does not contain errors.

1.12 Wreckage Information

There is no Wreckage Information related to this incident.

1.13 Medical and Pathological Information

All Flight crew were possessing Class 1 of Medical Certificate which were all valid and there was no medical and pathological information which may have adversely affected the flight.

[39] Ch-1 : Spare Seat, Ch-2 : The First Officer Seat, Ch-3 : The Captain Seat, Ch-4 : CAM (Cockpit Area Mike), Ch-5 : Mixed (Ch-1/2/3), Ch-6 : CAM of 2 hours length

1.14 Fire

Fire did not break out from this incident.

1.15 Survival Aspects

There was no item related to survival aspects due to this incident.

1.16 Tests and Research

There was no additional test related to this incident.

1.17 Organizational and Management Information

1.17.1 SPIC System of China Eastern Airlines

According to the statements of the fight crew, the first officer was performing PF at the left side seat which is the captain seat all the time while he was doing the flights CES5053 and 5054 on the date of incident. However, it was confirmed that it was based on SPIC (Second Pilot-In-Command) System which was approved to China Eastern Airlines by the General Administration of Civil Aviation of China and therefore it was not the violation of the flight regulations.

SPIC System is a system which trains the first officer for the duties of the captain before the first officer begins the education of the captain, and under the system the first officer who was appointed as the Second Pilot in Command is allowed to perform PF sitting at the left side seat (the captain seat).

In order for the first officer to get promotion to the captain, the first officer should obtain Airline Transport Pilot and for this PIC Time is required but most of the first officers working for civil airlines of China join the company right after the flight training and have been performing the role of the first officer. Therefore the first officers do not have aircraft flight control hours and the system is utilized for the purpose of securing the flight control hours for the first officers.

1.17.2 Dispatcher's Briefing

Flight Control support to China Eastern Airlines at the Daegu Airport has been handled by Korean Airlines but Korean Airlines did not assign the Dispatcher separately and assigned its staff in charge of Flight Management out of its operational staff to perform this service. Duty of this staff is to hand the flight related data generated from computer to the Captain who is positioned in the aircraft.

According to the statement of the Tower Controller dispatched to the Control Tower by Daegu Airport Representative Office of Busan Regional Aviation Administration, the information about the changed taxiing procedure and the newly installed curved Taxiway was propagated to the staff in charge of flight control of Asiana Airlines and Korean Airlines in Daegu Airport in line with the implementation of re-pavement work of RWY 31L-13R but it was confirmed that the information about new installation of the curved Taxiway was not delivered to the Flight Control Department of Head Offices and pilots.

1.18 Additional Information

1.18.1 The Captain's Testimonies

My experience of Daegu Airport was the second time after november last year. The first officer who was SPIC was taxiing at the left seat and I was performing PM role[40] at the right seat.

There was no information about the curved taxiway anywhere including Daegu Airport, ATIS, NOTAM and Jeppesen Chart and I did not receive information about the use of taxiway from the Tower Controller. SPIC was in charge of taxiing and I was thinking about going straight ahead only.

The Tower Controller gave the instruction of “Taxi straight ahead until W4, RWY 31R”, and I thought that I crossed Runway through W2 last time but this time it was straight ahead.

When Control Tower said “Follow yellow line,” it was already late. Control Tower neither said “Stop” nor “Hold.”

[40] PM(Pilot Monitoring) : in charge of verification, communication and checklist
PF(Pilot Flying) : in charge of actual aircraft operation

I saw a building but I did not think there would be a contact as the Tower Controller instructed to go straight ahead. I did not see Yellow line. I was sticking to the words of “Straight ahead.” As it was a military airbase, I disregarded the building thinking that it was for the fighter. I did not receive any information from company before the flight. At the Daegu Airport I received the flight data from the staff in charge of flight management and just signed it.

Taxi Speed was not fast and the Tower Controller said “Follow yellow line” once when we arrived the point where centerline branched. It would have been better if the Tower Controller said “Turn Right.” Only after we heard the sound of contact, there was the instruction of “Hold” from the Tower Controller.

SPIC’s operation at the left side is not for the training. It was approved by the General Administration of Civil Aviation of China while the company assigns duty using the term “SPIC” in the Flight Plan.

1.18.2 The First Officer's Testimonies

I had a flight to Daegu Airport last December and my experiences of Daegu Airport are 10 times including this flight. There was no information about Taxiway in “ATIS” or “ATC Clearance” and the Tower Controller did not give any other instruction except “Straight ahead” either.

Around the time when the Aircraft was passing the point where centerline branched, the Tower Controller gave us the instruction for “Follow yellow line” and I followed clear centerline but there was a contact with a “Bang.” The Tower Controller gave us instruction for “Follow yellow line” just once. I did not see Yellow line and accordingly I was not even hesitating at the point where centerline was branched. We stopped the aircraft first and then the Tower Controller gave us instruction to stop.

1.18.3 Testimonies of the Maintenance Engineer on Board

I was positioned at the back seat of the cockpit during the flight. At the destination airport, I perform the Line Maintenance and Release Aircraft work for flight. During the flight I did not hear the contents of communication. I did not wear headphone set. It was not my job.

The Aircraft followed the centerline. I was sitting without any thought and did not recognize the crooked yellow line because I did not pay attention to it. During taxiing, there was no particular dialogue between the Captain and the First Officer.

1.18.4 Other Captain's Testimony

I departed Daegu Airport with the Flight 000 at 13:30 hours on February 21, 2006. I received Taxi Clearance from Daegu Control Tower as “Taxi to Runway 31R via Taxiway 7”, and during taxiing from TWY 7, I received instruction for “Follow yellow line” in the middle of Taxiway W1 and W2 points.

At the location which passes Ground facilities located at the point which is after passing Taxiway W2, there is a new taxi guide line(Yellow) as in indication for detouring the facilities, and the clarity of the sign was up to the level at which the flight crew could recognize the sign.

Ground facilities which were near taxiway was located so near that the Flight crew have to consider the possibility of contact with Wing Tip in the case of taxiing straight along TWY 7, and it was possible to recognize the ground facilities before passing it while taxiing along the Taxiway.

At around 08:30 hours in the morning of the day, I had a flight 000 for the same block, and at that time the contents and time of instruction from the control authority were same as the above statement.

1.18.5 The Tower Controller's Testimonies

Investigation on the statements of the Ground Controller at the Ground Control seat of Daegu Control Tower who was in charge of Air Traffic Control for Aircraft 5054 and the Controller’s Team Leader was conducted at the office of Control Tower on February 22, 2006 by means of questions and responses together with the preparation of statements.

Major contents of the statement of the Tower Controller who was in charge of ground control for Aircraft 5054 is as follow:

- When the Aircraft started taxiing, came out taxiway 8 and waited on the west parallel taxiway, the information of “Taxi straight ahead until whiskey 4” was provided in order to let the Aircraft know that the existing procedure of crossing runway by way of taxiway W2 was changed to taxiing up to the end of west parallel taxiway effective from February 18.

- Aircraft 5054 has to reduce the speed after passing Taxiway 2 in order to follow Yellow line but the Aircraft did not show such indication and therefore immediately the instruction of "China Eastern 5054, Follow yellow line" was given and the Flight Crew's reading back was confirmed.

- As the Flight Crew read back, it was judged that the Aircraft would turn right even though the Aircraft went off the Yellow line but we could see that the Aircraft disregarded the instruction and went straight ahead.

- After the Aircraft passed PAR Site, we found that something strange at the roof edge of the PAR Site and the instruction of "Hold in position" was given.

The contents of the statement of the Tower Controller who was Duty Team Leader of Daegu Control Tower at the time of the occurrence of Aircraft 5054 incident are as follows:

- I saw that Aircraft 5054 was taxiing at the apron of Daegu Airport after obtaining ATC Clearance and taxi instruction.

- As all the blocks of west parallel taxiway were opened after February 18, 2006, second instruction was given to Ground Controller asking for alertness for the taxiing on the west parallel taxiway.

- I saw that Ground Controller gave instruction of "Follow yellow line" to Aircraft 5054 at the point where centerline of taxiway was branched.

- Right after the Flight Crew's reading back, it was judged that the Aircraft would turn right at the point of approximately 40m from the point where centerline of taxiway was branched and entered the centerline of taxiway but we found some wreckages at the Wing Tip and Wing Tip Fence and PAR Site after the Aircraft in question passed the upper part of the PAR Site building for approximately 10 seconds.

- The aircraft was asked to stop but the aircraft continued to go straight ahead. According to the second stop instruction, the Aircraft stopped and then immediately emergency measure was taken to the departments concerned.

2. Analysis

2.1 General

The Flight crew of Aircraft 5054 held the certificates required for the aircraft operation and the qualifications were all appropriate. And the Crews took appropriate rest before the flight and any medical factor which may adversely affect the flight operation was not found.

Aircraft 5054 was equipped with appropriate airworthiness certificate and applicable equipments, and appropriate maintenance was performed. And the flight within the national air space of the Republic of Korea was permitted based on the Aviation Act of the Republic of Korea, and Ferry Flight for return was performed by obtaining Flight Permit from the General Administration of Civil Aviation of China after taking appropriate measures.

Weight and balance of the Aircraft was within the range of stipulated limit value, and up to the point of time when Wing Tip of the Aircraft contacted the Building it was not found that Structure, Flight control and Engine System had defects.

In the investigation and analysis of the incident of this Aircraft 5054, the areas such as General, Incident Sequence, Flight crew' performance, Aerodrome facilities, Aviation Information Services and Aviation Traffic Control Service were reviewed.

2.2 Incident Sequence

Aircraft 5054 landed at Daegu Airport at 11:42 on February 21, 2006 as flight CES5053, and arrived at the terminal gate at 11:47. Afterward, the aircraft completed the preparation for another departure, and was pushed back as Flight CES5054 at 12:44.

Aircraft 5054 requested Taxi Clearance at 12:47 after completing Start, and the first officer who was SPIC performed taxiing at the captain seat (left side seat) while the Captain who was qualified for flight instructor supervised him at the first officer seat (right side seat).

Aircraft 5054 kept on taxiing after entering into west parallel Taxiway (TWY 7) and conducted

Take-off Briefing and Flight Control Check while maintaining taxi speed of 23-24 knots.

Then the flight crew of Aircraft 5054(including the Maintenance Engineer on Board) unconsciously went straight ahead along the erased centerline of taxiway which are not used while exchanging non-essential private conversations. Daegu Control Tower gave the instruction of "Follow yellow line" to the flight crew and the flight crew read back the instruction but simultaneously with the completion of the reading back wing tip and wing tip fence of the aircraft contacted with the building.

After hearing the sound of contact, the flight crew sensed that some problem was occurred to the aircraft but they did not know accurately about the place and nature of the problem. The flight crew stopped the Aircraft on the taxiway based on the instruction of Daegu Control Tower and shut down the engine.

2.3 Flight Crew's Performance

2.3.1 Nonessential Conversations

According to the item "Callouts" of General Information of FCTM[41] for the Boeing series aircrafts and the item "Sterile Cockpit Rule" of Normal Procedure and Communication of FCTM for Airbus series aircrafts, non-essential conversations at the critical phase of flight below 10,000 feet including taxi are not recommended.

The contents of FCTM for Boeing series aircrafts are as follows:

[Avoid casual and nonessential conversation during critical phases of flight, particularly during taxi, take off, approach and landing. Unnecessary conversation reduces crew efficiency and alertness and is not recommended when below 10,000 feet MSL/FL100]

[41] FCTM ; Flight Crew Training Manual

And also the contents of FCTM for Airbus series aircrafts are as follows:

[Below 10,000ft, any nonessential conversation within the cockpit and between the cockpit and the cabin should be avoided.....]

As we saw from the above, nonessential conversation may reduce alertness which enables to appropriately cope with potential problems, it is not recommended at the critical phase of flight including taxi.

However, according to the transcript of Cockpit Voice Recorder of Aircraft 5054, after entering the taxiway and completing the Flight Control Check and Take-off Briefing, the flight crew and the maintenance engineer on board continued exchanging nonessential conversations until just before the time of the aircraft's strike with the building. When we consider the situation in which the crew had cigarette related conversation like "Do not smoke," "I cannot stand it", we cannot preclude the fact that at least one person in the cockpit was smoking.

2.3.2 Negligent Operations of Aircraft

The Article 49 of the Aviation Act of the Republic of Korea stipulates that [Pilot of an aircraft should make a flight paying attention so that the aircraft does not come into collision with other aircraft or other objects.]

And also according to the item 2.3.1 (Responsibility of Pilot-in-Command) and 2.2 (Compliance with the Rules of the Air) of the Annex 2 (Rules of the Air) to the Convention on International Civil Aviation stipulates that [The Pilot-In-Command of an aircraft shall, whether manipulating the controls or not, be responsible for the operation of the aircraft in according with the rules of the air, and the operation of the aircraft either in flight or on the movement area of an aerodome shall be in compliance with the general rules.]

The item 3.1.1(Negligent of reckless operation of aircraft) and the item 3.2 (Avoidance of collisions) of the General Rules stipulates that [An aircraft shall not be operated in a negligent manner so as to endanger life or property of others, and it is important that vigilance for the purpose of detecting potential collisions be not relaxed on board an aircraft in flight, regardless of the type

of flight or the class of airspace in which the aircraft is operating, and while operating on the movement area of an aerodrome.

Especially Taxi in the movement area of aerodrome is divided into critical phases of flight, and FCTM of Boeing and Airbus series Aircrafts have the following provisions as “Safe and efficient guidelines during taxi”:

- When ground/obstruction clearance is in doubt, stop the airplane and obtain a wing-walker.
- Avoid distractions during critical taxi phases; plan ahead for checklist accomplishment and company communications.

As we saw from the above, especially the alertness to avoid collisions with ground obstacles is an item which has been always emphasized to the flight crew who operate the aircraft with long wings but in accordance with the confirmation based on the statements of the flight crew and the cockpit voice transcript, the flight crew of Aircraft 5054 did not have any suspicion on the obstacles and the erased centerline of taxiway at all, did not see yellow centerline of taxiway either and also nobody in the cockpit recognized what kind of problem was happened to the aircraft right after the contact. This is deemed to have happened because the flight crew at that time neglected their obligation to pay attention for potential collisions while taxiing in negligent manner.

However, according to the records from Control Recording and Cockpit Voice Recording, the Controller of Daegu Control Tower gave instruction of “Taxi straight ahead until whiskey four” when Aircraft 5054 entered Taxiway 8 and in the state where they stopped the Aircraft after the contact with the Building the flight crew exchanged conversations like “He instructed that straight ahead, didn’t he?” “Straight ahead, Ah, O.K”

This situation seems to have given influence the flight crew to be negligent in the alertness for potential obstacles and the verification of the centerline of taxiway, and it is judged that the flight crew's starting of taxiing without knowing any information on obstacle (PAR Site) and the curved taxiway contributed the flight crew of Aircraft 5054 to be negligent for alertness.

2.3.3 Non-adherence to Taxiway Centerline

According to the Table 3-1 (Taxiway minimum separation distances) of the Annex 14 (Aerodromes) to the Convention on International Civil Aviation, the minimum separation distances between Taxiway and obstacles is decided on the basis of the Taxiway Centerline, and according to the AIM Paragraph 2-3-4, b (Taxiway Centerline) of the U. S. AIM/FAR 2006[42], there is a stipulation that [Taxiway Centerline provides a visual cue to permit taxiing along a designated path. Ideally the aircraft should be kept centered over this line during taxi to ensure wing-tip clearance.]

Accordingly, the flight crew receive educations[43] to always keep taxiway centerline during taxi, and on actual flights, most flight crew taxi along yellow line unless they have special reason not to. And also the flight crew of Aircraft 5054 made the aircraft contact with the Building while going along the erased centerline of taxiway accurately. We can interpret that such fact explains the fact that the flight crew of Aircraft 5054 knew that "they have to go along the taxiway centerline always during taxi." We can infer that it explains the fact that the flight crew of Aircraft 5054 know that "Aircraft should always follow centerline of taxiway during taxi."

New curved taxiway had a capability to satisfy the flight condition of Aircraft 5054, and there has been no problem even though approximately 50 Civil Aircrafts used this place through the period of use for 3 days after the initial opening. Based on this situation, we can say that there would have not been any special problem also for Aircraft 5054 to taxi along the curved taxiway.

According to the reference statement of the captain of the Aircraft 000 which departed 15 minutes earlier than Aircraft 5054, he said that he did not have any problem in identifying the newly painted yellow centerline and taxiing along the centerline. And also the visibility in the meteorological data of the time was confirmed to have no problem for the flight crew to distinguish the yellow centerline from their seats.

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[42] AIM/FAR: Aeronautical Information Manual/Federal Aviation Regulations

[43] In the case of Taxiway without centerline, it is required to keep the center of the Taxiway.

They say that there was still the traces of erased centerline on the unused taxiway but as we can see from the [Picture 6], it is judged that there was no problem at all in distinguishing the newly painted yellow centerline on the newly installed curved taxiway and the erased centerline.

[Picture 6] Yellow Centerline of the Curved Taxiway

Accordingly, even though there was no problem for the flight crew of Aircraft 5054 to distinguish the yellow centerline and to make the aircraft taxi along the curved taxiway, it seems that they were not on the alert for the Building which had the possibility of potential collision, could not see the newly painted yellow centerline and continued to go along the erased centerline of unused taxiway without any suspicion or verification as they were making negligent flight exchanging non-essential conversations.

2.3.4 Request for Amended Clearance

The item b of AIM Paragraph 4-3-18 of AIM/FAR 2006 stipulates that [Although an ATC clearance is issued for taxiing purposes, it is the responsibility of the pilot to avoid collision with other aircraft. Since the pilot-in-command of an aircraft is directly responsible for, and is the final authority as to, the operation of that aircraft, the pilot should obtain clarification of any clearance or instruction which is not understood.] And also FAR 91.3 (a) states that [“The pilot-in-command of

an aircraft is directly responsible for, and is the final authority as to, the operation of that aircraft." If ATC issues a clearance that would cause a pilot to deviate from a rule or regulation, or in the pilot's opinion, would place the aircraft in jeopardy, it is the pilot's responsibility to request an amended clearance.]

The item 4.5.1.2 of DOC 4444(Air Traffic Management) of International Civil Aviation Organization stipulates that [If an aircraft control clearance is not suitable to the pilot-in-command of an aircraft, the flight crew may request and, if practicable, obtain an amended clearance.], and the item ② of the Article 207 (Performance of the Tower Controller's Instruction) of the Enforcement Rule of the Aviation Act of the Republic of Korea stipulates that [The pilot-In-Command of an aircraft should obtain clarification of instruction of the ATC which is unclear.]

Accordingly, if the contact was occurred during taxiing without the flight crew's verification of potential obstacle even though the Tower Controller of Daegu Control Tower gave the instruction of "Taxi straight ahead until whiskey four," it should be also regarded that the flight crew did not fulfill their responsibility. The reason for this is because General Rules stipulates that it is the responsibility of the flight crew that they should be always alert for the potential collisions and also they should make it clear through verification when a situation which is different from normal situation was detected.

2.4 Aerodrome Facilities

2.4.1 Construction of the curved taxiway

The design to install the curved taxiway was done to be able to secure safety distance with the obstacles[44] in both sides of the taxiway on the basis of the Span of B737-900 whereas the item 2 of the Article 53 of the Standard for Aerodrome Installation[45] announced by the Civil Aviation Safety Authority of the Ministry of Construction and Transportation and the item 14 of the Appendix 5 of Aerodrome Safety Operation Standard[46] and the standard stipulated in the Article 22 of the Aerodrome Markings Standard of the Advisory Circular[47] of the Federal Aviation Administration of the U. S. were not applied for the installation of the items such as Taxiway Edge Markings and Taxiway Shoulder Markings.

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[44] PAR Site Building and Airshed of Aircraft
[45] Announcement No. 2004-33 (Oct. 2, 2004)
[46] Announcement No. 2005-11 (Feb. 11, 2005)
[47] AC No. : 150/5340-1H(1999.8.31)

Taxiway Centerline Lights were installed in the block of the curved taxiway but the provision of the item 5.3.15.1 of the Annex 14 of ICAO stipulates that Taxiway Centerline Light should be installed on the taxiway which was to be used at the weather condition of Runway Visual Range of less than 350m but in the case of Daegu Airport it was used as taxiway in the state of Runway Visual Range of more than 1,200m and therefore it is judged that the installation of Taxiway Centerline Light was not necessary. Accordingly, it is judged that it would have been better to have installed the Taxiway Edge Lights connected to the taxiway nearby along the curved taxiway instead of installing Taxiway Centerline Lights only at the curved taxiway block.

2.4.2 Taxiway Marking

The provisions of the item 2.2 of Part 4 of ICAO Aerodrome Design Manual and the item 2 of the Article 53 of the Notification on "Aerodrome Facility Installation Standard" of the Civil Aviation Safety Authority of the Ministry of Construction and Transportation stipulate that when the edge of taxiway which can be basically used is not the same as the edge of the pavement surface Taxiway Edge Markings should be installed and additionally Taxiway Shoulder Markings should be installed as well.

At the time of incident, in the curved taxiway block only Taxiway Centerline Markings were installed and Taxiway Edge Markings or Taxiway Shoulder Markings were not installed even though there was the existing taxiway pavement surface which cannot be used by the aircrafts of bigger than B737-900 aircraft between the curved taxiway and PAR Site. Therefore it is judged that the pavement surface which should not be used by aircrafts could not be easily recognized.

As the "Aerodrome Painting"[48] Regulation of ROKAF did not set the standard for Taxiway Edge Markings and Taxiway Shoulder Markings, it is judged that the regulation cannot satisfy the Markings installation standard of Aerodrome facilities where civil aircrafts are operated, and also it is judged to be necessary to establish the standard for the Aerodrome facilities which can be used by civil aircrafts in the military aerodrome.

[48] ROKAF Regulation No. 9-27(Revised on Mar. 1, 1997)

2.5 Aeronautical Information Services

2.5.1 NOTAM

According to the statement of the staff in charge in the department in charge of delivery of NOTAM for flight information of Daegu Aerodrome, NOTAM was not issued because the change of some block in the straight taxiway to the curved taxiway was applicable to the item (1) of "C" category "Information related to Taxiway, Gate, Apron and Stopway" among the items which cannot be announced as NOTAM stipulated in the item 3 of the Section 2 of the Chapter 6 of the Flight Information Service Regulation of ROKAF. But it was propagated to the Authorities concerned[49] through the meeting of Construction related officers and instruction was given to the Tower Controller of Daegu Control Tower to render radio advice to the flight crew.

The category "A" of the item 1 (General) of the Section 2 of the Chapter 6 of the Flight Information Service Regulation stipulates that "the information about the aerodrome facilities published in the Flight Information Publications should be recorded always accurately…" and the item 2 (Items which should be always announced as NOTAM) of the said Regulation specifies the category "D" for "Information about the aerodrome facilities which may give restraints or become obstacles to the aircraft operation" and the category "F" for "Ground obstacles which may affect the aircraft operation or …. Information." And therefore it is judged that the change of taxiway to the curved taxiway due to the reason that PAR Site became the obstacle for the normal operation of the straight Taxiway[50] was the item which should be announced as NOTAM.

As taxiway was registered as Aerodrome facility in the 'Aerodrome Chart" of the Flight Information Publication, the information for the change to curved taxiway should be registered as correction, and it is judged that in case the cycle of registration in the Flight Information Publication could not be adhered to for some reason, the information should have been announced as NOTAM.

As the item (1) of the category "C" specified "Information related to Taxiway, Gate, Apron and Stopway" among the items which cannot be announced as NOTAM referred to in the item 3 of the Section 2 of the Chapter 6 of the Flight Information Service Regulation, it is judged that the review of the said Regulation will be necessary as there is a possibility of contradicting interpretation on the items which can be announced as NOTAM by the staff in charge in the department in charge of its issuance.

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[49] Staff of Busan Regional Aviation Administration and its Daegu Airport Representative Office

[50] Taxiway is one of the "basic Airport facilities" together with Runway and Gate.

Even though we regard the "Information related to Taxiway, Gate, Apron and Stopway" which was specified in the Flight Information Service Regulation as the information about taxiway if the information is specified as "Ordinary repairing work of Apron and Taxiway which do not affect the safe moving of aircrafts" stipulated in the provisions of the Annex 15 of ICAO and the item 1 of the Article 30 of the Aviation Information Service Regulation[51] of the Civil Aviation Safety Authority of the Ministry of Construction and Transportation, it is judged that the items which should be announced as NOTAM and the items which cannot be announced will be clearly distinguished.

Especially as all aeronautical information of the airports which the international liner aircrafts use apply global common method, it is judged to be appropriate to revise the Flight Information Service Regulation as such actively referring to the Aeronautical Information Service Regulations of civil aviation such as ICAO.

2.5.2 AIP

In accordance with the movement of PAR Antenna and Equipment Room building so that they are close to the existing straight taxiway, the problem for the straight taxiway was occurred, and the change of the straight taxiway to curved taxiway to secure safety distance from obstacles was permanent aeronautical information applicable to critical change of aerodrome, which is judged to be the item to be propagated to all airmen including Crews of aircraft.

Information about the permanent change of taxiway is the item which requires the publication of revised edition of Aeronautical Information Publication[52] and it should have been published before using the curved taxiway. And in case the registration for the revision was not done within the revision cycle for Aeronautical Information Publication due to the reason of uncertain date for the opening of the curved taxiway operation, it is judged that the information should have been propagated at least 7 days before the operation of the curved taxiway as NOTAM and revision action should have been taken within the earliest Aeronautical Information Publication revision cycle.

The Article 5 of the Aeronautical Information Service Regulation stipulates that the Aeronautical Information Service Organization for Daegu Airport is Busan Regional Aviation Administration, the office for NOTAM should be located in the Flight Information Office of Daegu Airport Representative Office and the Manager in charge of notification of Aeronautical Information should be designated by competent Aviation facility.

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[51] Adheres to the provisions of Notification No. 2005-39(Aug. 31, 2005) of the Civil Aviation Safety Authority and the ANNEX 15 of ICAO

[52] According to the ROKAF Regulation, it is expressed as Flight Information Publication

However, as the Manager in charge of notification of Aeronautical Information for the aviation facilities under the military control was not designated at the civil airport which uses military aerodrome, it is judged to be reasonable that military authority notifies the Manager based on the Agreement for the Use of Military Airbase. But as the Article 8 of the Aviation Information Service Regulation stipulates that Aeronautical Information Service Organization should compile the information from "other available sources" and therefore it is judged that the detailed procedure should be established so that Aeronautical Information is compiled and propagated on a timely basis although military authority does not notify the information.

There has been no precedence where pertinent military authority notified the item related to the curved taxiway as Aeonnautical Information to Daegu Airport Representative Office through formal propagation system. But a staff of Daegu Airport Representative Office already perceived the information from approximately 7 months before the occurrence of the incident through the participation in the meetings related to Daegu Airport main runway re-pavement work but the staff did not think that the information should be propagated as Aeronautical Information and therefore the staff did not take the action[53] to publish NOTAM or the revised edition of Aeronautical Information Publication up until the time of the occurrence of the incident.

2.5.3 ATIS

As ATIS of Daegu Airport is a System which can broadcast only the meteorological and aerodrome information of Daegu Airport stored in the computer as voice data, the controller has to notify new information which is necessary for the aircraft operation but is not stored in the System in advance at the time of every air traffic instruction whenever the new information is generated, which is judged to have adverse effect such as overload for the performance of air traffic control service.

In order to satisfy the purpose of the installation of ATIS to enhance the efficiency of Air Traffic Control Service, to reduce air traffic frequency congestion and to provide essential safety operation information to the flight crew more conveniently, it is judged that there is a need to improve the equipment so that the controller can always directly record with voice and broadcast the new information which was not stored in advance.

[53] Either request to issue NOTAM to military authority or notify Busan Regional Aviation Administration which is Aviation Information Service Organization

2.5.4 Propagation to the Flight Crew

Flight operation staff of Korean Airlines who is handling flight operation support to China Eastern Airlines flying to Daegu Airport was verbally notified on the information about the installation of the curved taxiway from the Flight Information Office Staff several times but he did not propagated the information to the flight crew. It is estimated to be the result of poor understanding about Aeronautical Information or inaccurate recognition of the importance of Aeronautical Information.

2.6 Air Traffic Control Services

2.6.1 Ground Control to the Aircraft

When Aircraft 5054 requested taxi clearance to control tower from the apron, Ground Controller gave taxi clearance saying “China Eastern 5054 taxi to Runway 31 Right, Altimeter 3016” but it was not clear air traffic control clearance as to which taxiway the flight crew should take because the route to runway was not provided.

When Aircraft 5054 was taxiing on the Taxiway 8, the air traffic control instruction was given saying “China Eastern 5054 taxi straight ahead until Whiskey 4” in order to make the aircraft go to the end of Taxiway 8 along the west taxiway[54] not by way of Taxiway W2. But if the Tower Controller included the route of taxi in his instruction saying like “China Eastern 5054 taxi to Runway 31 via Taxiway 8, Taxiway 7 and whiskey 4” when he gave taxi clearance to Aircraft 5054 which was at the apron, the intention of the Controller to taxi up to Whiskey 4 taxiway along Taxiway 7 would have been clearly delivered to the flight crew, and therefore it is judged that the Air Traffic Control Instruction saying “China Eastern 5054 taxi straight ahead until Whiskey 4” would have been unnecessary.

[54] The statement of the Ground Controller at that time

2.6.2 Provision of Advisory Information

According to the statement of the ground controller and FDR records, Aircraft 5054 had to reduce taxi speed after passing Taxiway W2 in order to go along the curved taxiway but the Aircraft did not show such indication. Therefore the instruction of "China Eastern 5054 follow yellow line" was given to the aircraft immediately and in 7.6 seconds after then the left Wing Tip and Wing Tip Fence impacted PAR Site.

Taxi speed of Aircraft 5054 was 24 knots at the time of collision and when the Wing Tip of Aircraft 5054 was at 93.8m front area from PAR Site – it was a 73.3m front area from PAR Site measuring from Nose gear-, the Ground Controller gave instruction of "China Eastern 5054 follow yellow line", and when we consider the fact that the distance between PAR Site and the starting point of centerline of the curved taxiway was 82.1m, it was analyzed that the Aircraft was at the point 8.8m after passing the starting point of yellow centerline of the curved taxiway.

While continuing to taxi, the flight crew of Aircraft 5054 read back Air Traffic Control Instruction but the situation was that yellow line could not be seen from the front of the cockpit and considering the fact that there was a collision right after the reading back, it is judged that such advising instruction of the controller was already too late to prevent the mistake of the collision with PAR Site due to the pilot's carelessness of not following the centerline of the curved taxiway.

At the time of the incident, if the Edge Markings or Shoulder Markings for the curved taxiway were properly installed in accordance with pertinent regulations or the information about the curved taxiway and obstacle was broadcasting through ATIS and the flight crew could have the information on the curved taxiway or obstacle in advance as the information was propagated through Aeronautical Information Publication or NOTAM, such Air Traffic Control Advisory would be unnecessary.

But if the Authority concerned recognized the absence of such marking facilities and let the Controller give necessary advice to the aircrafts which were to operate on the curved taxiway, it was desirable to have provided the Control Advising Instruction with sufficient time in advance like when the Aircraft was at the apron. And also it is judged to have been helpful to comply with the instruction if the reason or situation was clearly added when providing advice or information.[55]

[55] Ex; Follow yellow line due to building/obstacle left side of taxiway 7 or Caution, big obstacle left side of taxiway 7 etc.

The Ground Controller who saw Aircraft 5054 which collided with PAR Site was continuing to taxi used the term “China Eastern 5054, Hold in position” to stop Aircraft 5054. But under this situation the Controller should have used the term “Hold position” as stipulated in the item 3-7-2 of the Standard Aviation Traffic Control Procedure.

As stipulated in the item 3-9-4 of the Standard Aviation Traffic Control Procedure, the term “Hold in position” is a term to be used at the time of additional instruction to prevent the possibility for sudden starting of taxi for take-off by a aircraft which is waiting on runway for take-off, the term was inappropriately used under the situation at that time. It is judged that right control term should be accurately selected and used for a situation so that the intention of the controller is accurately and promptly delivered to the Flight crew.

2.6.3 Roles of Civil ATC Coordinator

The provision of the Article 8 of the “Agreement on the Use of Daegu Airbase for Civil Aircraft” stipulates that the Controller of Daegu Airport Representative Office, Busan Regional Aviation Administration has to be permanently stationed at Daegu Control Tower from the initial flight to the completion of final flight and to cooperate with the department concerned of Daegu Airport Representative Office and Daegu Branch of Korea Airports Corporation after coordinating with military Controller about flight control pf civil aircrafts, supervision of pilots’ compliance with various regulations and control related service among civil/military/government.

While the Controller of Control Tower performs Aerodrome Control service, the Controller has to verify the pilots’ compliance of various regulation and to provide advice on the control service on real time basis but civil Controller was not positioned at the Control Tower in the morning and afternoon of the day of incident occurrence and therefore the Controller was not in a position to supervise the civil aircraft pilots’ compliance with various regulation stipulated in the said agreement or military Controller’s provision of appropriate Control Instruction or information so that civil aircrafts can comply with various regulations or to provide relevant advices.

When we consolidate the statements of the persons concerned in the process of site investigation, the said agreement specified that civil Controller should be permanently positioned at the Control Tower but it is judged that the manager in charge of Daegu Airport Representative Office was not at all controlling the Controller’s physically leaving the Control Tower even though the Controller was performing pertinent duties based on his own judgment. Moreover, it is also judged that the Manager did not correctly perceive the purpose and intention of the permanent positioning and did not comply with the provisions of the agreement correctly either.

3. Conclusions

As a result of the investigation, the ARAIB developed findings derived from the factual information and the analysis of the Aircraft 5054 incident. There are three different categories of findings: findings related to probable causes, findings related to risk, and other findings.

The **Findings related to probable causes** identify elements that have been shown to have operated in the incident, or almost certainly operated in this incident. These findings are associated with unsafe acts, unsafe conditions, or safety deficiencies associated with safety significant events that played a major role in the circumstances leading to this incident.

The **Findings related to risk** identify elements that have the potential to degrade aviation safety. Some of the findings in this category identify unsafe acts, unsafe conditions, and safety deficiencies, including organizational and system risks, that have the potential to degrade aviation safety ; however, they cannot be clearly shown to have operated in the incident. Further, some of the findings in this category identify risks that are unrelated to this incident, but nonetheless were safety deficiencies that may warrant future safety actions.

Other Findings identify elements that have the potential to enhance aviation safety, resolve an issue of controversy, or clarify an issue of unsolved ambiguity. Some of these findings are of general interest and are not necessarily analytical, but are often included in the ICAO format of incident/accident reports for informational, safety awareness, education, and improvement purposes.

Note: Findings are a key part of this report and published solely to identify safety deficiencies and risk for the prevention of future incidents/accidents. Any use of the findings to assign blame or liability would be a violation of international aviation law and international best practices, including those contained in Annex 13, Chapter 3, Paragraph 3.1, and Chapter 5, Paragraph 5.4.1, to the Convention on International Civil Aviation.

3.1 Findings Related to Probable Causes

1. While taxiing, the flight crew did not fully perform "Pilot's obligation for caution" such as being negligent in watching for all directions and verifying ground markings.

2. The following factors constituted a chain of event and contributed to the errors made by the flight crew of Aircraft 5054:

- The flight crew was taxiing without knowing the information on the curved taxiway and obstacles (PAR building);

- The control tower's "Taxi straight ahead" instruction to Aircraft 5054 when the aircraft entered the parallel taxiway where the curved taxiway was located;

- Non-installation of a taxiway edge marking which would enable the flight crew to recognize the pavement surface not to be used by aircraft.

3.2 Findings Related to Risk

1. The flight crew of Aircraft 5054 exchanged non-essential conversations at the critical phases of flight and was taxiing with negligent attitude.

2. It was impossible for the flight crew to recognize that the pavement surface could not be used by aircraft because there were no Taxiway Lights, Taxiway Edge Markings or Taxiway Shoulder Markings indicated along the curved taxiway.

3. The change from the straight taxiway to the curved taxiway was not published as NOTAM, and was not recorded in the Aeronautical Information Publications, Flight Information Publications and Jeppesen Chart.

4. The control tower controller gave an instruction "Taxi straight ahead until whiskey four" after Aircraft 5054 entered taxiway 8.

5. The centerline marked in yellow color on the taxiway not in use had been erased in a scratching method, however, the trace of the centerline was still remaining in white color at the time of the incident.

6. Airlines' personnel in charge of flight operations support for Aircraft 5054 did not have enough perception on aviation information, thus did not provide the information on the curved taxiway to the flight crew.

7. The Aeronautical Information Service organization stipulates that aeronautical information should be compiled from available sources but did not designate the personnel to be in charge of aeronautical information notification for each competent aviation facility, and the Flight Information Office at Daegu Airport recognized the matters on the curved taxiway but did not recognize them as the aeronautical information which should have been propagated through official systems.

8. The civil controller did not comply with the agreement on the permanent stationing at the control tower, and was not performing the role of supervising civil aircraft on the compliance with various regulations or the role of advising the military controller to provide appropriate control services for civil aircraft to comply with various regulations.

9. In the installation design of taxiways used by civil aircraft, the standards related to civil aviation were not applied.

3.3 Other Findings

1. The flight crew of Aircraft 5054 were certified and qualified for the operation of the aircraft, and there was no evidence of any medical problems that would have affected the flight crew's performance.

2. Airworthiness certificate of the aircraft was valid, and the required maintenance was performed, and no defects were found in the fuselage of the aircraft, or its systems prior to the occurrence of the incident.

3. Weather at the time of the incident was visual meteorological condition, and there was no problem with visibility for the flight crew to verify obstacles and the yellow centerline on the taxiway while taxiing, and the ground controller could clearly see the taxiing of Aircraft 5054.

4. The first officer seated on the left (the captain's seat) was handling the taxiing of Aircraft 5054, which was in accordance with the SPIC System of China Eastern Airlines, not in violation of the flight regulations.

5. The controller who provided ground control service for Aircraft 5054 possessed the required qualification to perform his duties.

6. There were no communication failures between the flight crew of Aircraft 5054 and the ground controller of Daegu Control Tower.

7. Aeronautical information is the information necessary for the safety, rules and efficiency of air navigation, and pertinent regulations stipulate that the information should be notified to flight crew and air traffic service organizations in an accurate and timely manner.

8. The fact that the existing straight taxiway was changed to the curved taxiway is a critical change item about a part of the aerodrome, which is the aeronautical information to be provided to flight crew.

9. The Pertinent regulation stipulates that aeronautical information service organization should compile aeronautical information from available sources.

10. The information on all airport facilities recorded in the Flight Information Publication should be always accurate, and the pertinent regulation stipulates that when acknowledged necessary to urgently propagate the information on new item not recorded in the Flight Information Publication, the information should be immediately propagated as NOTAM.

11. According to the flight information service regulations, it is specified that the “Information related to taxiway…..” is the item not to be notified as NOTAM, which is contradictory to the provision in the same regulations “Information about taxiway as airport facility should be notified as NOTAM.”

12. The pertinent regulation stipulates that the information about airport facilities which may restrain or impede the operation of aircraft, or the information about the ground obstacles which may affect the operation of aircraft is the item which can be notified as NOTAM.

13. The pertinent regulation stipulates that in Aeronautical Information Publication, when there is not enough time to amend an existing information as the information to be changed permanently, NOTAM should be promptly issued.

14. The pertinent regulation stipulates that a critical change in the operation of aerodrome is the item for which NOTAM should be issued whereas ordinary repairing work of taxiway not affecting the safe movements of aircraft is the item for which NOTAM should not be issued.

15. ATIS of Daegu Airport was the system which could broadcast only the pre-recorded voice data, and the information about the curved taxiway or obstacle (PAR) was not stored in the system.

16. The design for the curved taxiway installation required to secure safe distance from obstacles in both sides of taxiway, based on the span of the B737-900 aircraft type.

17. The pertinent regulation stipulates that taxiway centerline lights should be installed on the taxiway which is to be used in the weather condition of Runway Visual Range less than 350 m but the taxiways of Daegu Airport were used in the weather condition of Runway Visual Range more than 1,200 m.

18. The pertinent regulation stipulates that when the edges of a basically usable taxiway are not the same as the edge of pavement surfaces, taxiway edge markings should be installed, and taxiway shoulder markings should be also installed in addition.

19. In the flight painting regulations of the ROKAF, the standards on taxiway edge markings and taxiway shoulder markings were not stipulated.

20. The time when the ground controller gave the instruction of “China Eastern 5054, follow yellow line” was the time when the cockpit area of the aircraft already passed the starting point of the yellow centerline on the taxiway by 8.8 m.

21. The pertinent regulation stipulates that pilots should operate flights, paying attention not to collide with other aircraft or other objects.

22. The pertinent regulation stipulates that when an instruction from the air traffic control facility is not clear, pilots should verify the contents of the instruction.

4. Safety Recommendations

As a result of the investigation of Aircraft 5054 incident, the ARAIB developed safety recommendations to relevant organizations as follows. However, since the edge markings for the curved taxiway were installed right after the incident, and the information on the curved taxiway was recorded in the Aviation Information Publication as of March 30, 2006, safety recommendations pertaining to these items were deliberately omitted.

China Eastern Airlines

1. The following items should be reflected in flight crew training and flight operation procedure:(AIR F0601-1)

   - Non-essential conversations should be avoided during critical phases of flight below 10,000 feet including taxi;

   - Aircraft should not be operated in a negligent manner bringing on danger to human life or property, and flight crew should always stay vigilant for potential collisions while operating on the movement area of an aerodrome, regardless of the type of flight or the class of airspace;

   - In order to ensure the safety of aircraft wing tips ideally during taxi, the aircraft should always keep the taxiway centerline, and as safety guidelines during taxi, when separation from obstacles is in doubt, hold the aircraft, and assign a wing-walker;

   - The Captain is in direct charge of controlling an aircraft, having the final authority. If ATC issues a clearance that would cause flight crew to violate a rule or regulation, or it is deemed that the aircraft would be in danger by following the clearance, flight crew should request an amendment to the clearance from ATC, and requesting the amended clearance is the responsibility of flight crew.

Busan Regional Aviation Administration (Civil Aviation Safety Authority)

1. A review is urged on a method to establish a system preventing the omission of aeronautical information collection related to civil aviation, by designating the personnel to be in charge of aeronautical information notification for each aviation facility of the military aerodrome used by civil aircraft, and assigning the responsibility to each airport representative office for collecting aeronautical information on competent military aviation facility.(AIR F0601-2)

2. A review is urged on a method for the civil controller to practically contribute to the safe operation of civil aircraft, by re-emphasizing the compliance with the principle and purpose of the agreement between the organizations concerned on the civil controller allocated in the control tower of the military aerodrome used by civil aircraft, or by reexamining the necessity of allocation of the civil controller to the control tower. (AIR F0601-3)

R.O.K Air Force(ROKAF)

1. A review is urged on a method to amend the installation standards of aviation facilities including taxiways of military aerodromes used by civil aircraft, in order to meet international civil aviation standards.(AIR F0601-4)

2. A review is urged on a method to amend the items on the issuance of NOTAM in flight information service regulations by referring to civil aviation regulations pertaining to NOTAM, in order for the handling personnel to understand the items on the issuance of NOTAM accurately. (AIR F0601-5)

3. A review is urged on a method to positively apply the air traffic control phraseologies and standards prescribed in air traffic control procedures commonly applied by civil and military, in the case of providing air traffic control services to civil aircraft. (AIR F0601-6)

Korea Airports Corporation (KAC)

1. A review is urged on a method to satisfy the purpose of the ATIS installation by improving the ATIS for controllers to be able to directly record and broadcast in voice at any time whenever new aeronautical information not stored in advance is brought about. (AIR F0601-7)

Korean Airlines

1. Ensure the thorough propagation of necessary aeronautical information by the flight operation personnel of each airport to the flight crew on the respective aircraft is to be accomplished by positively compiling and understanding the official or non-official aeronautical information of the competent airport, and conduct training to raise the flight crew perception of the importance on aeronautical information for the safe operation of aircraft. (AIR F0601-8)