Aviation and Railway Accident Investigation Board
Report No. ARAIB/AAR0801

AIRCRAFT ACCIDENT REPORT

CRASHED INTO TERRAIN DURING LANDING
THE KOREA FAMILY FEDERATION MISSIONARY FOR WORLD PEACE AND UNIFICATION
S92A2, HL9292
GAPYEONG-GUN, GYEONGGI-DO, REPUBLIC OF KOREA
19 JULY 2008

8 JUNE 2011

AVIATION AND RAILWAY ACCIDENT INVESTIGATION BOARD
MINISTRY OF LAND, TRANSPORT AND MARITIME AFFAIRS
REPUBLIC OF KOREA

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

> *The accident investigation shall be conducted separately from any judicial, administrative disposition or administrative lawsuit proceedings associated with civil or criminal liability.*

And in the Annex 13 to the Convention on International Civil Aviation, Paragraphs 3.1 and 5.4.1, it is stipulated 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 the activity to apportion blame or liability. Any investigation conducted in accordance with the provision of this Annex shall be separate from any judicial or administrative proceedings to apportion blame or liability.*

Thus, this investigation report issued as the result of the investigation on the basis of the Aviation and Railway Accident Investigation Act of the Republic of Korea and the Annex 13 to the Convention on International Civil Aviation, shall not be used for any other purpose than to improve aviation safety.

In case of divergent interpretation of this report between the Korean and English languages, the Korean text shall prevail.

Aircraft Accident Investigation Report

Aviation and Railway Accident Investigation Board, Crashed into terrain during landing, The Korea Family Federation Missionary for World Peace and Unification, S92A2 helicopter, HL9292, Gapyeong-gun, Gyeonggi-do, 19 July 2008. Aircraft Accident Report ARAIB/AAR0801, Seoul, Republic of Korea

The Aviation and Railway Accident Investigation Board (ARAIB), Republic of Korea, is a government organization established for independent investigation of aviation and railway accidents, and the ARAIB conducts accident investigation in accordance with the provisions of the Aviation and Railway Accident Investigation Act of the Republic of Korea and Annex 13 to the Convention on International Civil Aviation.

The objective of the investigation by the ARAIB is not to apportion blame or liability but to prevent accidents and incidents.

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Helicopter crash into terrain during landing

The Korea Family Federation Missionary for World Peace and Unification,
Republic of Korea
S92A2, HL9292
Gapyeong-gun, Gyeonggi-do, Republic of Korea
19 July 2008 at 17:06 (Korea Standard Time[1])

Synopsis

On 19 July 2008, rotorcraft HL9292 of the Korea Family Federation Missionary for World Peace and Unification (hereinafter referred to as "Missionary") was due to land at the Cheongsim International Hospital Heliport. While approaching to land, the aircraft passed the heliport in clouds. Then the pilot performed a go-around but lost control and crashed into trees halfway up the Janglak Mountain. HL9292 was totally destroyed by a fire that broke out immediately after the crash, and of the 16 persons on board, six including the captain were seriously injured and 10 had minor injuries.

The Aviation and Railway Accident Investigation Board (hereinafter referred to as "ARAIB") determines that the probable cause of this accident was that despite that the flight crew could not visually identify the helipad because it was covered with clouds in bad weather conditions, they attempted to land unreasonably at a high speed in the autopilot mode and failed to maintain a proper flight attitude during the go-around, so they impacted on the ground. Contributing to the accident were ①the flight mission was decided to be made in variable bad weather conditions, ②the co-pilot failed to give proper advice to the captain on the flight mission, en-route flight, final approach and the captain's improper decision and action in the go-around section after passing the helipad, and when the captain lost the flight attitude in a vertigo, he failed to take a proper defensive action, ③depite that the weather was not suitable for visual flight due to an indirect influence of typhoon, the Tong-il Aviation failed to provide the captain with positive operational support such as analyzing weather trends or recommending cancellation of the flight mission, and ④HL9292 was not applied with the specifications for EGPWS of the MMEL (flight is not allowed in case of its malfunction).

As a result of its investigation of this accident, the ARAIB makes 2 recommendations to the Ministry of Land, Transport and Maritime Affairs (Office of Civil Aviation), 3 recommendations to the Missionary, 7 recommendations to the Tongil Aviation.

1) Unless otherwise indicated, all times in this Report are Korea Standard Time based on 24 hours.

1. Factual Information

1.1 History of Flight

The rotorcraft HL9292 of the Missionary departed Jamsil Heliport[2] at about 16:48 on 19 July 2008 for airlift of personnel. While landing on Cheonsim International Hospital Heliport[3] (hereinafter referred to as "Hospital Heliport"), it passed the heliport in clouds and crashed into terrain halfway up the Janglak Mountain at 17:06:29". After the crash, it caught fire and was totally destroyed.

HL9292 was a private rotorcraft operating in accordance with the Aviation Act of the Republic of Korea, and it was flying under the visual flight rules. The number of crew and passengers aboard the aircraft at the time of the accident were a total of 16 persons including the captain, a co-pilot, an on-board maintenance personnel and 13 passengers.

The flight mission of HL9292 was to transport attendees to the "Marriott Hotel Event"[4] by air from the Hospital Heliport to Jamsil Heliport back and forth.

According to the statements made by the pilots, they got up around 06:00 on the day of the accident and had breakfast[5] with the on-board maintenance personnel on 07:20～08:20. And then the co-pilot and the on-board maintenance personnel carried out preflight check on HL9292 in the hangar by the Hospital Heliport on 08:20～08:40.

In connection with the flight mission, the captain received a phone call from an aide[6] around 07:00 and 08:00 asking whether flight was possible or not. He reported flight was impossible since the weather at the time was raining due to an indirect influence of a typhoon.

Once again the captain phoned to the manager of Jamsil Heliport around 11:30 to confirm destination weather status. After he found out the weather had improved[7], he

2) A heliport constructed on the Jamsil Dock on the riverside of the Hangang (in front of Seoul Olympic Stadium), Jamsil-dong, Songpa-gu, Seoul
3) A heliport of Cheongsim International Hospital (hospital owned by the Missionary) located in Seolak-myeon, Gapyeong-gun, Gyeonngi-do, Republic of Korea
4) A religious event held at Marriott Hotel located in Banpo-dong, Seocho-gu, Seoul
5) They ate to their liking at a restaurant located in Songsan-ri, Seolak-myeon, Gapyeong-gun, Gyeonggi-do.
6) A special aide to the president of "Missionary" in charge of planning and ordering the flight mission for the president

decided to fly and reported the aide that flight was possible.

After preflight check, the co-pilot and on-board maintenance personnel went up to their quarters and waited for the captain's instruction for the flight duties of 11:30 flight. Then the co-pilot submitted a flight plan[8] at 11:40 by phone to the Flight Information Office of the Air Traffic Center.

After a while passengers arrived at the heliport, the HL9292 took off[9] the Hospital Heliport at 12:10, flew along the Bukhangang and arrived at Jamsil Heliport at 12:31.

After HL9292 arrived at Jamsil Heliport, the passengers and crew members attended the "Merriott Hotel Event.". At about 16:10, which was 30 minutes before takeoff from Jamsil Heliport, before anybody else, only the crew members returned to heliport for flight preparations. At this time the captain confirmed[10] the weather in the vicinity of the Hospital Heliport by phoning the worker at the gate of the museum beside the Hospital Heliport and he concluded return flight would be possible.

At 16:47:28 HL9292 took off[11] from Jamsil Helipad and contacted the control tower of Seoul Airport at 16:48:11. At this time the air traffic controller of Seoul Airport said he could not give clearance for passing the control zone since the weather at the Seoul Airport was visibility 1.5 miles with rain, and the co-pilot of HL9292 replied to the controller according to the captain's instruction that there would be no problem with flying since the visibility was about 2.5 miles.

Subsequently HL9292 flew along the Hangang to Paldang, it flew along the Bukhangang from Paldang to Hospital Heliport. After taking off from Jamsil Heliport to Cheongpyeong Dam, HL9292 flew at a speed of 90～130 kts at an altitude of 1,000 ft[12] more or less.

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7) The heliport manager replied that "rain stopped and horizontal visibility is good with no winds."
8) Departure point: RKBC, arrival point: RKSJ, departure time: 12:00, estimated arrival time: 12:20 (flying time 20 minutes)
9) We recorded the move time of HL9292 based on the time reported to the Aviation Information Office.
10) He asked the gate worker of the museum, "Can you see the mountains around?" and the worker said that he could see. Therefore, the visibility is judged to be more than 2 miles. (The captain requested the worker to personally go to the helipad to confirm.)
11) The time reported to the Aviation Information Office was 16:40, but in this report we recorded the time on FDR as the flight time from Jamsil Heliport to the time when the accident occurred.
12) Mean sea level (MSL) is applied below unless otherwise indicated.

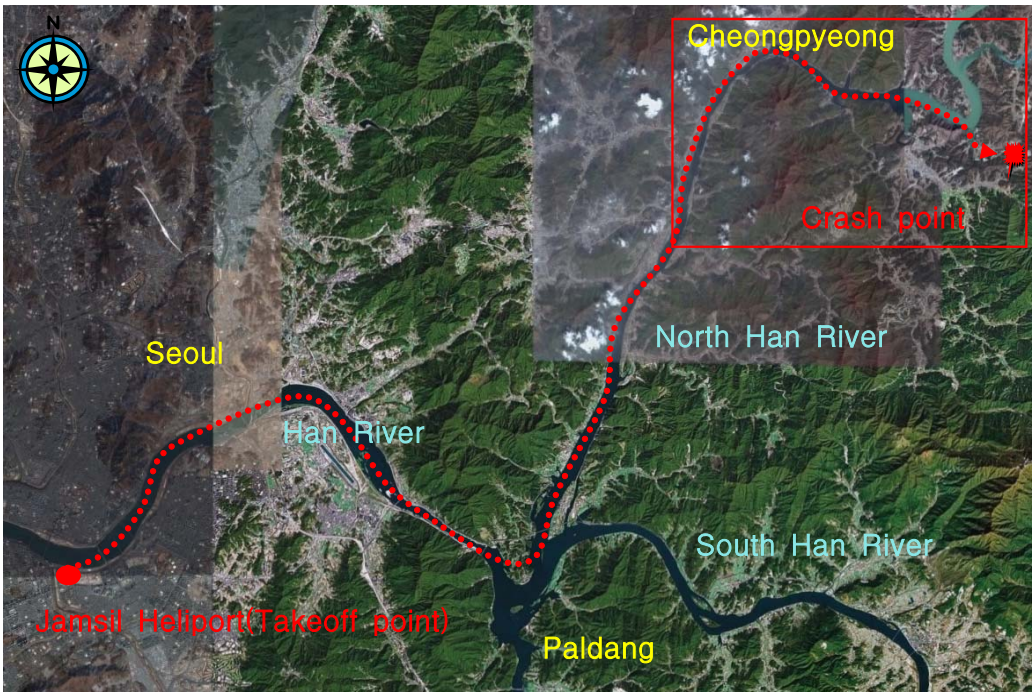
HL9292 was in autopilot mode at 16:46:25 before takeoff from Jamsil Heliport, and displayed weather radar at 16:56:27. And at 17:04:15, after passing Cheongpeong Dam, it reduced the speed to about 60 kts for landing at the destination.

At 17:04:35.8 the captain mentioned, "the pad should be in sight by now," and at 17:04:39.9 the co-pilot replied, "the beacon light is not in sight ... yet."

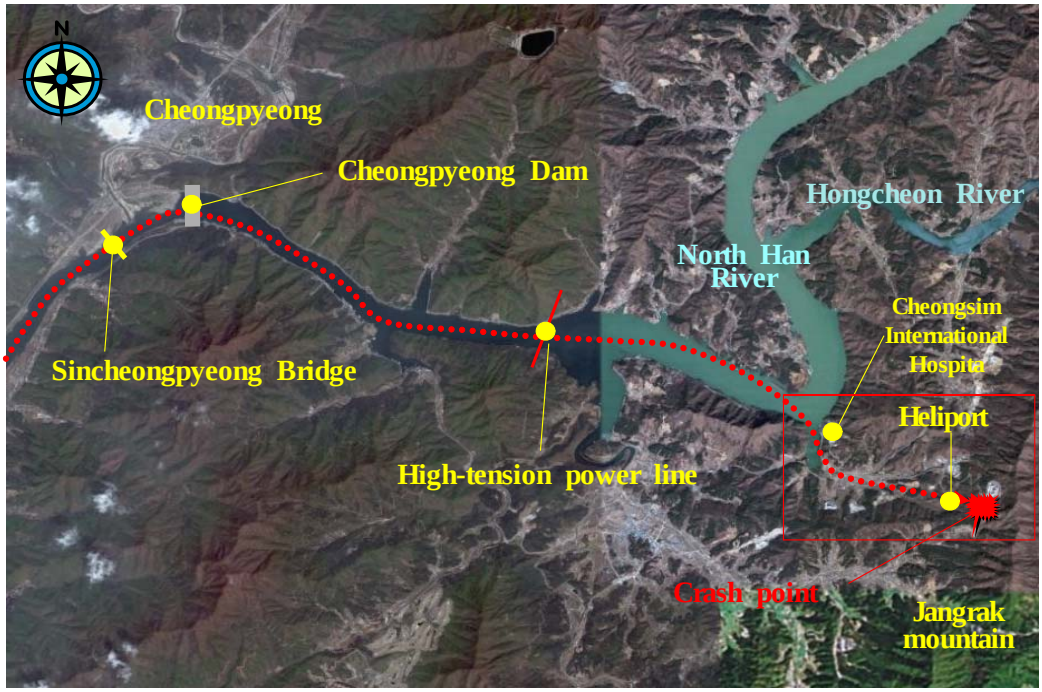
Subsequently, the captain descended instrument altitude to 650 ft, and for about 40 seconds from 17:04:55 to 17:05:34.9, he asked the co-pilot eight times whether he could see the Hospital Heliport or not. The captain said, "Oh～! I can't see... Can you see? Can't you see?" and the co-pilot replied that it was not in sight.

Subsequently, while passing by the Hospital Heliport at 17:05:39.9, the co-pilot cried out, "Oh! we have just passed it!" and at 17:05:41.2, about one second later, he advised the captain to turn right, saying "Right turn!" After that the captain released the autopilot mode of the helicopter and controlled it manually.

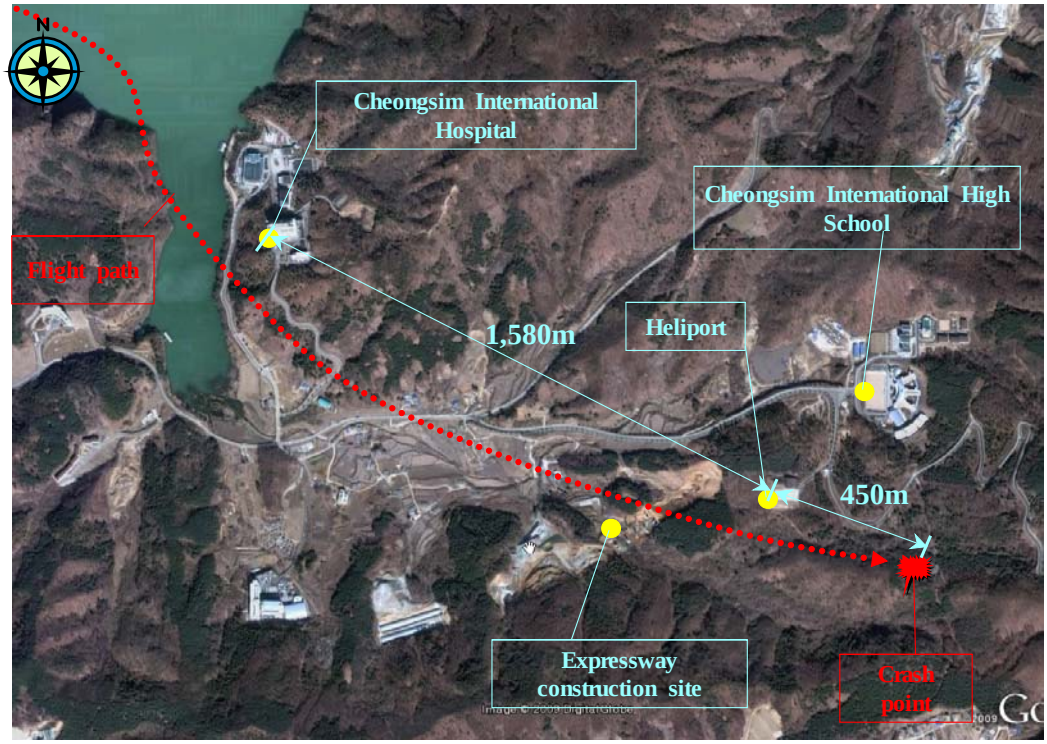
[Photo 1] is the flight path from Jamsil Heliport to the crash point, and [Photos 2 and 3] are the details of the flight path.



[Photo 1] Overview from Jamsil Heliport to crash site



[Photo 2] Flight path from Cheongpyeong Dam to crash site



[Photo 3] Flight path from Cheongsim International Hospital to crash site

HL9292 flew at a speed of 62 kts for about 1 minute and 30 seconds, from 17:04:15 to 17:05:44.5, the moment the autopilot mode was released. Then for about 21 seconds, from 17:05:51 to 17:06:12, the aircraft made a 360 degree right turn climbing almost in the same place at a speed of 0 kts.

At 17:06:13, HL9292 accelerated rapidly with the nose down, and it crashed with a sharp drop in altitude.

After the crash, the passengers evacuated from the aircraft helped by the on-board maintenance personnel and the co-pilot, and then the helicopter was totally destroyed by fire from its right engine portion.

1.2 Injuries to Person

Classification	Flight Crew	Passenger	Other
Fatal	0	0	0
Serious	1	5	0
Minor/None	2	8	0
Total	3	13	0

1.3 Damage to Aircraft

HL9292 was totally destroyed by impact forces and a post crash fire. The price of the aircraft of HL9292 was $19,898,000 and it was subscribed[13] to aircraft insurance[14] and passenger accident insurance[15], and was within the insurance expiration date at the time of the accident. [Photo 4] shows the wreckage of the helicopter after the fire was extinguished.

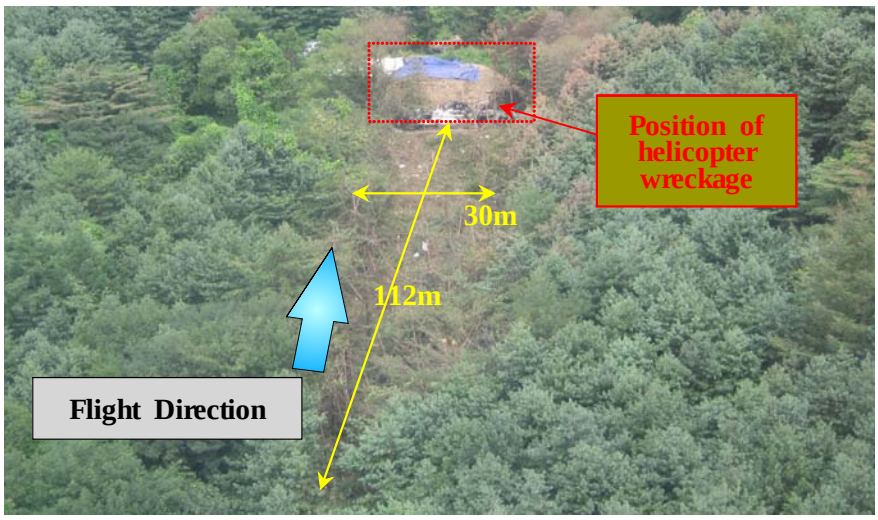
13) LIG insurance against loss: June 3, 2008 to June 2, 2009
14) 19,898,000 US dollars
15) Two pilots (150,000 SDR per person), 15 passengers (150,000 SDR per person)
※SDR: Special Drawing Right

[Photo 4] Wreckage of the helicopter after fire was extinguished

1.4 Other Damage

When HL9292 impacted the ground, the forest was damaged 112m long and 30m wide. After HL9292 crashed, the loaded fuel and oil leaked to contaminate soil 5m wide and 15m long.

[Photo 5] is an overview of the helicopter crash site.



[Photo 5] Overview of the helicopter crash site

1.5 Personnel Information

1.5.1 The Captain

The captain (male, age 59) has served Navy Aviation Corps as a pilot for about 14 years. Until he was discharged from military service on 31 January 1986, he had flown on[16] a total of six aircraft types for 2,987.3 hours including 1,445 hours as an instructor pilot and 1,192.6 hours as a full time pilot.

After he was discharged from military service, the captain was employed by Korean Air, Ltd. on 17 November, 1987, and had accumulated a total of 1,907.4 flight hours[17]. Then, he changed his employment to Samsung Techwin on 25 April 1994 and flew a total of 5,867.6 hours[18]. He was employed by the present company Tong-il Aviation System (hereinafter referred to as "Tong-il Aviation" on 22 September 2005 and flew 534.1 hours.

His flight time[19] on the relevant type of aircraft is a total of 534.1 hours including 22.9 hours as an instructor pilot and 477.2 hours as a captain. Following is his recent flying time: 1.9 hours in the last 24 hours, 12.4 hours in the last 30 days, and 35.5 hours for the last 90 days.

After he was employed by the Tong-il Aviation, he received transition training[20] for S92 at FSI[21] in Florida using a flight simulator. And after that he received two additional recurrent trainings from the same training agency.

The captain's instrument flight experience was a total of 904.6 hours including 545.7 hours of actual instrument flight, 80 hours of instrument flight hooded cockpit and 278.9 hours of simulator instrument flight, of which the instrument flight experience on S92 was 74.9 hours of actual instrument flight and 34 hours of

16) 500MD: 1,854 hours, BO-105: 264.1 hours, O-1: 488.3 hours, OH-23: 217.3 hours, OH-58: 355.5 hours, U-17: 2 hours, U-6: 70.4hours; total 3,251.6 hours
17) B-727: 671.4 hours, BO-105: 264.1 hours, AS-332: 328.9 hours, S-365: 643 hours; total 1,907.4 hours (as a captain: 795.4 hours, instructor pilot: 0 hours)
18) 342: 237.7 hours, PA-31: 7.9 hours, S-332: 887.1 hours, S-355: 19.6 hours, S-365: 4,715.2 hours; total 5,867.6 hours (4,599.2 hours as captain, 540.5 hours as instructor pilot)
19) Calculated based on the Pilot Individual Flying Time Record issued by the Tong-il Aviation System as of July 18, 2002.
20) S92(FAA901), Flying time: 6 hours (right: 5, left: 1), ground school: 90 hours
21) FSI: Flight Safety International, manufacturer's educational institute located in Florida

simulator instrument flight.

His recent instrument flight experience.: Of 4.5 hours of flight time on 12 April 2008 he completed 1.8 hours as a daytime actual instrument flight, and completed 8 hours of simulator instrument flight at FSI from 7 to 9 July 2008.

The certificates and type rating held by the captain are as follows;

○ Airman's certificate
- Airline transport pilot: certificate number 917(date of issue: 27 July 1993)
- Type rating
  - Airplane land single engine (1981. 10. 21)
  - Rotorcraft land multi engine, rotorcraft instrument flight, SA365(1988. 11. 15)
  - Rotorcraft land multi engine BO105(1989. 4. 13)
  - Airplane land multi engine B727(1991. 6. 4)
  - Rotorcraft land multi engine AS332(1992. 5. 19)
  - Rotorcraft instructor(1993. 9. 10)
  - Rotorcraft land multi engine AS355N(1996. 6. 5)
  - Rotorcraft land multi engine S92(2006. 5. 4)

○ Radio operator certificate: certificate number 893400073(1989. 6. 9)

The captain was considered "physically fit" as a result of the airmen medical examination[22] pursuant to Aviation Act Article 31.

1.5.2 Co-Pilot

The co-pilot (male, age 41) has served Navy Aviation Corps as a rotorcraft pilot for about 13 years. He had flown a total of 3,023,1 hours[23] including 200.8 hours as an instructor pilot and 1.895.7 hours as a captain on three types of aircraft until he was discharged from military service on 1 May 2003.

The co-pilot was discharged from military service before he was employed by S-Oil, Ltd. on 20 February 2006, and flew 82.5 hours on S76B until 19 July 2007. He

22) Certificate issue number: 025-6370, term of validity: 2007. 7. 10 ~ 2008. 7. 31
23) 500MD: 132.2 hours, LYNX: 200.2 hours, OH-23: 42.5 hours; total 3,023.1 hours

was employed by the Tong-il Aviation, the present management company, on 23 July 2007 and flew only S92 for 72.7 hours.

The co-pilot received S92 transition training from the captain, instructor pilot of S92 of the Tong-il Aviation, from 16 August to 14 October 2007 and completed the recurrent training course from 7 to 11 July 2008 at FSI of the United States.

The co-pilot's experience of instrument flight is a total of 349.4 hours including 242.2 hours for actual instrument flight, 55.8 hours for hood instrument flight, and 51.4 hours for simulator instrument flight. Of that, the experience of instrument flight for the S92 type is 9.5 hours for actual instrument flight and 8 hours for simulator instrument flight.

The co-pilot's recent instrument flight experience is daytime actual instrument flight of 0.5 hour during 3-hour flight on June 10, 2008 and simulator instrument flight of 8 hours from 7 July to 9 July 2008.

The co-pilots flying time on the relevant type of aircraft is a total of 93.4 hours including 1 hour as a captain and 18.2 hours as a student. And the co-pilot's recent flying time is 0 hour for the last 24 hours, 11.7 hours for the last 30 days and 49.2 hours for the last 90 days.

The certificates and type rating held by the co-pilot are as follows.

- ○ Airman's certificate
  - Airline transport pilot: certificate number 3137(2007. 4. 24.)
  - Type rating
    - Rotorcraft instrument flight(2006. 6. 20)
    - Rotorcraft instructor(2006. 11. 23)
    - Rotorcraft land multi engine S76(2006. 6. 13)
    - Rotorcraft land multi engine S92(2007. 11. 29)
- ○ Special class radio operator certificate: certificate number 02-34-2-0004(2002. 5. 2)

The co-pilot was considered "physically fit" as a result of airmen medical examination[24] pursuant to Aviation Act Article 31.

24) Certificate issue number: 025-6782, term of validity: 2007. 8. 16 ~ 2008. 8. 31

1.5.3 On-board Maintenance personnel

The on-board maintenance personnel completed two years of aircraft maintenance training from 1998 to June 2000 at an training institution of aircraft maintenance[25] located in Melbourne, Australia.

After completion of his training, he worked as an aircraft maintenance personnel in the same training institution before he was employed by the Tong-il Aviation as a maintenance personnel on 1 Dec. 2004 and worked until 20 April 2008. He has been working for the Missionary from 21 April 2008 to the day of the accident.

The on-board maintenance personnel completed the S92 type initial training course from 11 April to 18 April 2008 at a training center[26] located in Florida, the United States.

The airman's certificate held by the on-board maintenance personnel is as follows;

○ Airman's certificate
- Aircraft maintenance personnel: certificate number 8138(2005. 5. 19)

1.6 Aircraft Information

HL9292 was manufactured[27] by Sikorsky Company in the United States on 1 July 2005 and was introduced by Times Aerospace Korea Limited Liability Corp.[28] (hereinafter referred as "Times Aerospace Korea") and was initially registered[29] as a private aircraft on 1 June 2006.

After that the ownership was transferred to and registered[30] by the Missionary on 24

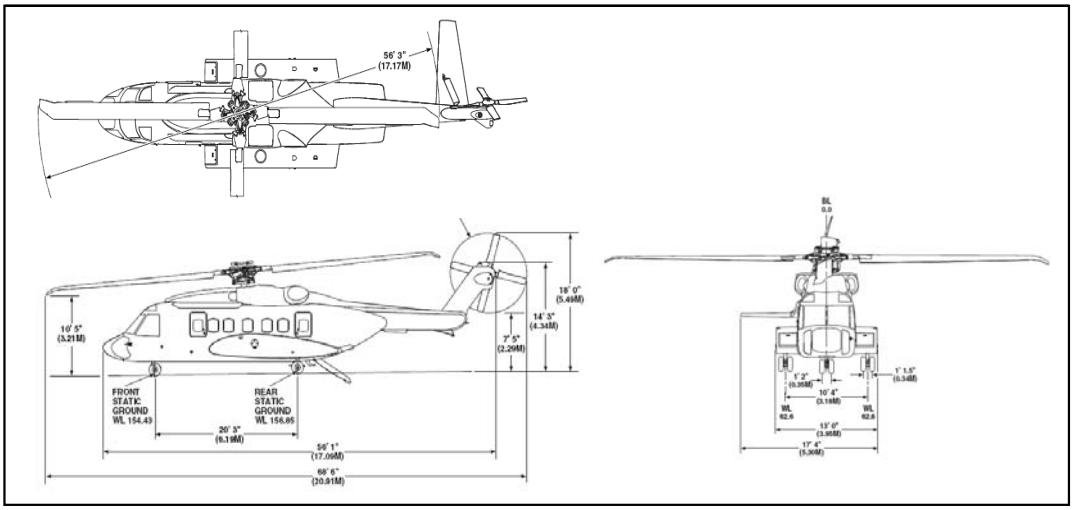
25) Kangan Batman TAPE (Kangan Professional School): A trainingl institution for aircraft and automobile maintenance addressed mainly to immigrants who have studied in Australia; besides this, there are various kinds of TAPE in Australia specializing in car maintenance, hotel management, language training, etc.
26) Flight Safety International, GE Training Center
27) Type: S92A2, manufacture serial number: 920020
28) Times Aerospace Korea Limited Liability Corp. is an aircraft maintenance company and was providing maintenance support during the operation of HL929 type, but it did not have AMO for the S92 type.
29) Registration certificate number: 2006-030
30) Registration certificate number: 2006-044, date of issue: 2006. 7. 24

July 2006. By the time of the accident, its total flying time had been 389.5 hours and the total number of flights had been 680.

Two turboshaft engines[31] of CT7-8A manufactured by General Electric Co. of the United States on 28 April 2005, were mounted[32] on HL9292. By the time of the accident, the total hours of service had been accumulated 389.5 and the total number of engine start had been 554.

The registration certificate[33], airworthiness certificate[34], operation limit designation[35], noise certificate[36], and radio station permit[37] of H9292 were all valid.

1.6.1 Aircraft Specification



○ Size

- Length:
  - Main rotor～tail rotor: 20.91m
  - Length of fuselage: 17.09m
- Width: 17.17m (with main rotor mounted), 5.30m (with no main rotor mounted)
- Height: 5.49m (including tail rotor)

31) Type: CT7-8A, serial numbers: GE-E947243, GE-E947244
32) 29 June 2005
33) Certificate number: 2006-044(2006. 7. 24)
34) Certificate number: AS08042, date of issue: 2008. 5. 29
35) Designation number: ASOL08042, date of issue: 2008. 5. 29
36) Certificate number: NS06007, date of issue: 2006. 6. 1
37) Permit number: 46-2006-10-0000012, date of issue: 2006. 8. 31

○ Engine
- Power output: 2,520 SHP × 2
- Fuel: Jet A-1

○ Performance
- Speed: 250 km/h (Cruising), 305 km/h (maximum)
- Weight: (Max.)26,500 lbs(12,020 kg), (min.)16,200 lbs(7,348 kg)
- Seats: 19 persons

1.6.2 Aircraft Maintenance Discrepancies

According to the testimony made by the pilots and on-board maintenance personnel, they could not find any abnormal signs in the fuselage, engines and control systems of HL9292 at the preflight check on the day of accident, and all systems were operated normally during the flight.

However, HL9292 had trouble with the EGPWS (Enhanced Ground Proximity Warning System) during flight on 16 July 2008 and flew with not operating status at the time of the accident.

According to the MMEL (Master Minimum Equipment List)[38] provided by the manufacturer for the S92A2 type, it is clearly stated that if the equipment listed in the list failed, it should be repaired before the next flight after a specified period, and the other equipments (excluding the equipment for entertaining the passengers and galley equipment) should be operating normally. As for the EGPWS, flight is possible for one day if audible alarm is operating and flight is not allowed if it is not operating.

According to the Fight Operation Technical Standard 1.1.1.4 and 8.1.2 (Definition of terms) that were effective at the time of the accident, MEL is defined the equipment list that was prepared by the air transport operator and was approved by the aviation supervisory authorities. In the same Standard 8.1.6.3 (Required maintenance items), it is provided that an aircraft owner or operator shall abide by

38) An equipment list made by the manufacturer with intention to allow flight of the aircraft installed with malfunctioning equipment for a minimum period necessary for maintenance of the equipment in preparation for a malfunction of specific equipment under specific conditions and provided to the operator after obtaining approval of the designing country.

the item, "Unless permitted in the Minimum Equipment List, any not-working instrument or equipment that requires a check next time shall be repaired, exchanged, demounted or inspected."

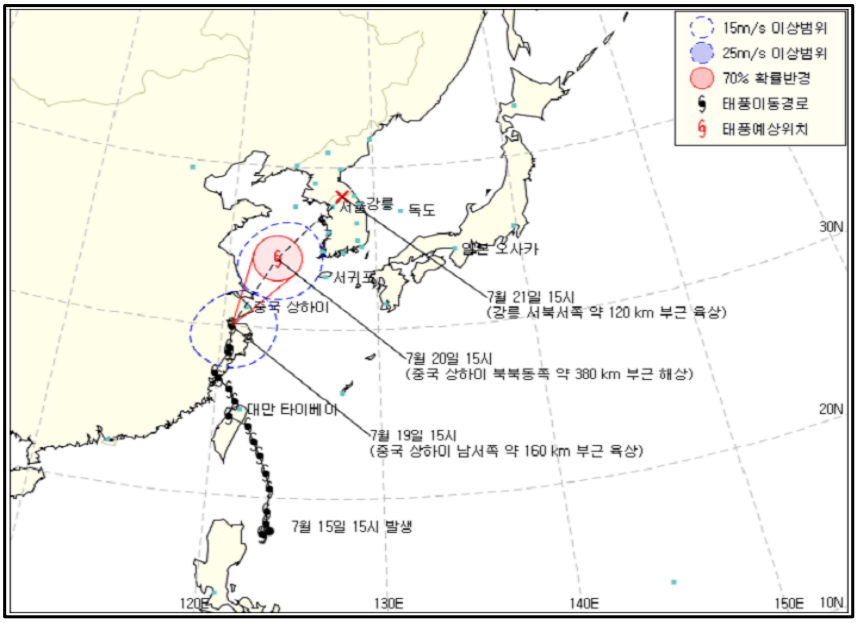
Therefore, it is not clear whether the principal that should prepare and enforce the MEL based on the MMEL is all aircraft or transport aircraft. As a result, Tong-il Aviation determined that it was not necessary to prepare a MEL since the HL9292 helicopter is not a transport aircraft, and flew without applying the MMEL.

1.7 Meteorological Information

1.7.1 General

At the time of the accident, the Korean Peninsula area was under the influence of No. 7 typhoon, known as "Galmaigi," which was going up north. For that reason, the meteorological conditions were low ceiling and there were rain showers in many parts of the country.

[Fig. 1] and [Table 1] are showing the special weather report of typhoon "Galmaigi" and the location of the typhoon at the time.



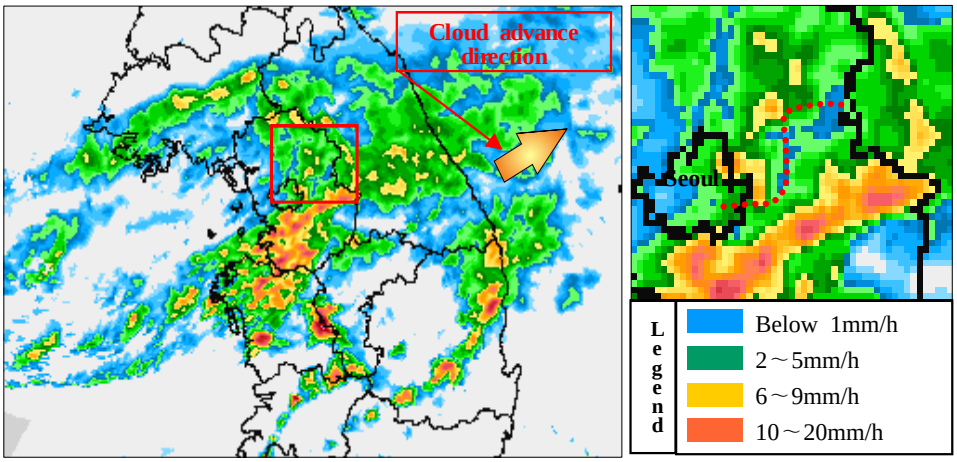
[Fig. 1] Location and expected path of typhoon "Galmaigi"

Date & Time	Center position	Center pressure(hPa) Maximum wind speed(m/s)	Gale radius(km) [Exception radius]	Strength and size	Advance direction speed (km/h)
As of 19th at 15:00	30.0 N, 120.6 E	994, 18 (65km/h)	280(Northwest about 210)	Weak, small	North, 27
Expected 15:00 on 20th	34.3 N, 123.3 E	994, 18 (65km/h)	280(Northwest about 210)	Weak, small	North northeast 23
Expected 15:00 on 21st	38.2 N, 127.7 E	1000			Northeast, 25

[Table 1] Special weather report of typhoon "Galmaigi" as of 15:00 on 19 July

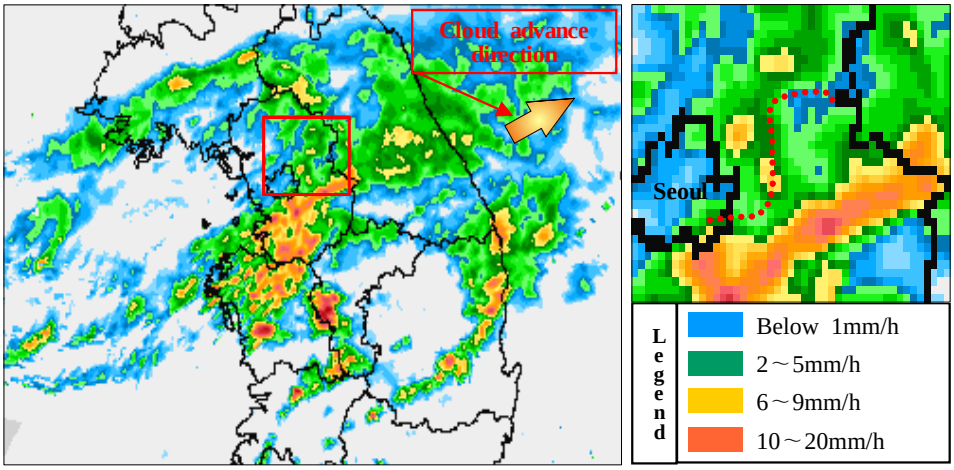
Figs. [2, 3, 4 and 5] below show the cloud conditions in the vicinity of the HL9292 flight path by time slot at the time of the accident.

According to [Fig. 2], a strong cloud zone of about 20 mm per hour was formed south of the flight path (red dotted line) at 16:40, and heavy rain cloud zones of about 6～9mm per hour were formed also west of the flight path and northwest of the landing planned point. However, regardless of harsh weather condition, there was rainfall less than about 1 mm per hour only at the crash point.



[Fig. 2] Rain cloud distribution shown on radar screen 16:40

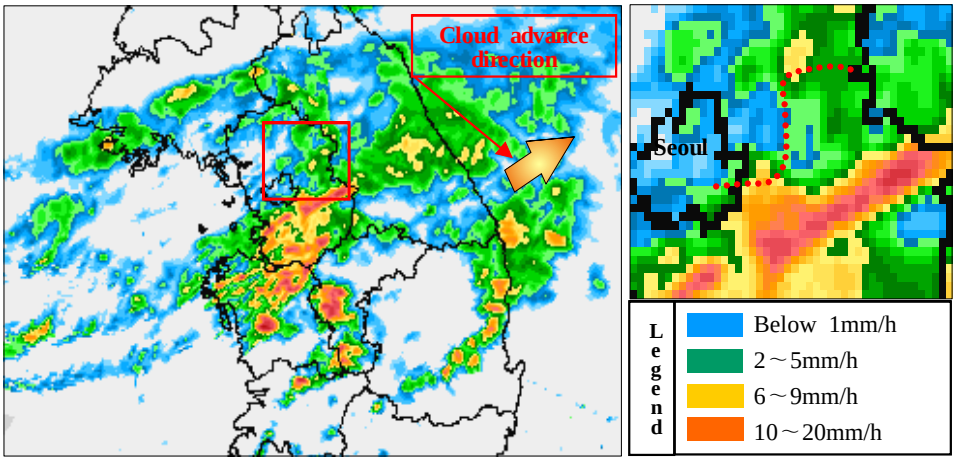
As shown in [Fig. 3], clouds were moving toward east on the whole, and especially the weak rain cloud of the landing point was going out east.



[Fig. 3] Rain cloud distribution shown on radar screen 16:50

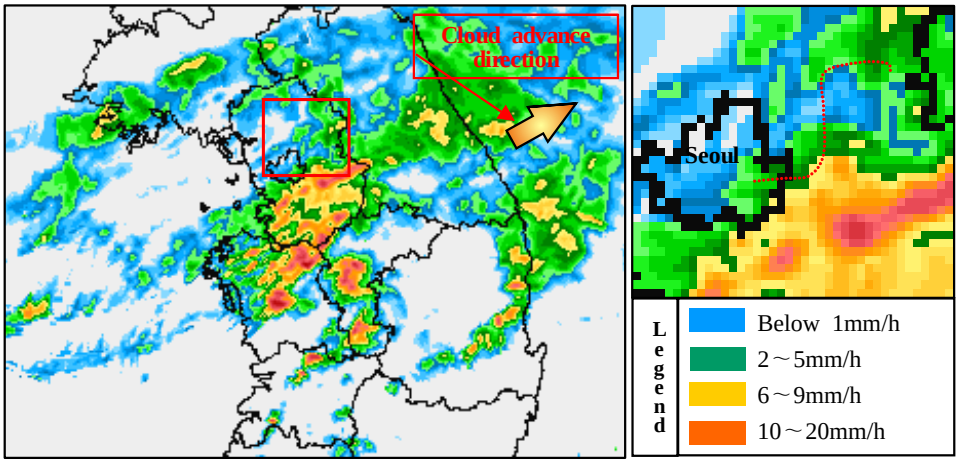
In [Fig. 4] at 17:00, a strong rain cloud zone of about 10～20 mm per hour was positioned lengthily east to west in the south of the flight path, and on the flight path a weak rain cloud of less than 1 mm per hour was approaching from the west.

But near the landing point, the weak rain cloud zone of less than 1 mm per hour that was distributed until 10 minutes earlier is going out to east while a rain cloud zone of about 2～5 mm per hour is pushing and covering from the west.



[Fig. 4] Rain cloud distribution shown radar screen 17:00

As shown in [Fig. 5], at 17:10 the clouds near the landing point are moving northeast and the rain clouds are becoming weaker.



[Fig. 5] Rain cloud distribution shown on radar screen 17:10

1.7.2 Weather of Seoul Airport

The Jamsil Heliport that HL9292 used on the day of accident is located within the controlled airspace[39] of Seoul Airport. Therefore, when HL9292 takes off from the Jamsil Heliport to return the Hospital Heliport, the weather limits of Seoul Airport are applicable.

The weather of Seoul Airport observed by Seoul Airport Weather Watch at 16:30, about 15 minutes before HL9292 takes off from the Jamsil Heliport, and at 17:00 are as follows.

Classification	Visibility (mile)	Wind direction (degree) Wind speed (kts)	Ceiling & Cloudiness[40]	Precipitation
16:30	1 1/2	170 / 05	FEW 0, BKN1,500 OVC3,000	11mm/h
17:00	2	180 / 05	FEW 0, SCT 800, BKN1,500, OVC3,000	11mm/h

[Table 2] Seoul Airport weather watch data

39) Airfield radius 5NM altitude 3,000 ft

40) A sign for marking a timed meteorological condition in METAR); to indicate the quantity of cloud, the whole sky is divided into eight according to the size of cloud covering the sky to mark in five kinds of SKC (sky clear), FEW (Few: 1/8～2/8), SCT (Scatter: 3/8～4/8), BKN(Broken: 5/8～7/8), OVC(Overcast: 8/8), and then the height from ground to cloud is marked in ft.

As shown in [Table 2] above, the visibility of Seoul Airport at about 16:30 was below visual meteorological condition, and there were small clouds existed partially near the ground surface with the ceilings of 1,500 ft and 3,000 ft covering in double layers.

1.7.3 Weather of Accident Site

The Hospital Heliport on which HL9292 was scheduled to land did not have an officially approved weather observation facility. Therefore, in order to find out the local weather at the time of accident, it has to be estimated through the weather observation radar images and the weather data measured by the weather observation facility nearest to the site, or utilized the actual weather as observed by the local residents.

Upon checking the weather observation radar images (See Figs. 4 and 5) at the time of the crash, it was concluded that a rain cloud zone of about 2～5 mm per hour was covering over the crash point.

The nearest weather observation facilities from the crash point are located in Chuncheon[41] and Yangpyeong[42]. However, these two points are too far away from the crash point so that they were not so reliable in estimating the variable local weather.

According to the statement made by witnesses[43], it was continuously raining in the vicinity of the heliport from the time when they arrived at the heliport to the time when they perceived the fact of the helicopter crash, and they could faintly see a tree[44] which is planted at the end of the heliport due to a cloud/fog.

But according to the statement made by the janitor, visibility was good to the extent that mountains nearby could be seen although it was raining when he went down to the heliport to confirm[45] the weather after he was asked by the captain about the weather around the Hospital Heliport.

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41) About 30 km northeast of the crash point
42) About 20 km south of the crash point
43) Two operators of the vehicles to be used for the transportation of the helicopter passengers, they arrived at about 17:00, about 10 minutes before arrival of the helicopter; since it was raining they were waiting in the vehicles watching the helicopter approach direction.
44) It is located about 72 m from the position of the operators' vehicles.
45) Since it was before HL9292 departed the Jamsil Heliport that the gate worker received a phone call from the captain, it is judged about 16:30.

1.7.4 Regulations and Limitations of Weather

An aircraft flying under visual flight rules should have clearance from clouds at least 1,500 m (5,000 ft) horizontally and 300 m (1,000 ft) vertically in airspaces B, C, D and E and a distance in which it is possible to identify the ground surface with the naked eye and avoid clouds in airspace G. And it should fly in weather condition with flight visibility of more than 5 km in all airspaces, pursuant to Article 184 (Prohibition of visual flight), Article 184-4 (Flight visibility and distance from clouds) and Attached Table 3-2 (Good weather condition in terms of visibility) of Aviation Act Enforcement Regulations that were in effect at the time.

However, it is clearly stated that "a rotorcraft may fly in flight visibility condition with a visibility of less than 1,500 m if it is moving at a speed at which it can see and avoid another aircraft or obstacle to prevent collision."

It is specified in the operation manual of the Missionary (19-3), (Takeoff and landing minimums of "D" class heliport or a takeoff and landing place other than an airfield) that visual flight should be made in weather conditions with visibility more than 5 km and ceiling more than 450 m (1,500 ft).

1.8 Aids to Navigation

HL9292 did not use aids to navigation on the day of accident, however, the lighting facilities (heliport lighthouse, wind direction light, landing area perimeter light, etc.) of the heliport were operated normally.

1.9 Communications

HL9292 communicated on the day of accident with Seoul Airport Control Tower and MCRC[46] using the radio on board the aircraft and any evidence of communication failure was not found.

46) MCRC: Master Control and Reporting Center

1.10 Heliport Information

HL9292 flew on the day of accident from the Hospital Heliport (RKBC) to the Jamsil Heliport (RKSJ) back and forth. So the Hospital Heliport and Jamsil Heliport are described below.

1.10.1 Jamsil Heliport (RKSJ)

Jamsil Heliport is located[47] on the south riverside[48] of the Hangang, Jamsil 1-dong, Songpa-gu, Seoul, in which there are three concrete helipads 20 m by 20 m. The elevation of the heliport is 10 m (33 ft), which was constructed on 26 December 1992. It is a Class C[49] heliport, which was put into service on 30 December 1992.

In the region of the heliport, Cheongdam Bridge is located, 1 km northwest of the heliport, Jamsil Bridge is located about 1.7 km northeast, and the Olympic Sports Complex is located about 250m south.

This location is a point included in the controlled airspace of Seoul Airport which is adjacent to RK P-73 VFR Route CP-1 (check point 1).

North of the heliport, there is the Han River flowing a width of about 850m from east to west, and the heliport is separated about 30m from the waterside.

There are no aids to navigation installed at Jamsil Heliport. Only one wind direction indicator was installed beside the guard room. And the maintenance of the heliport has been done by the owners[50] of the helicopters, and there is just one guard on duty.

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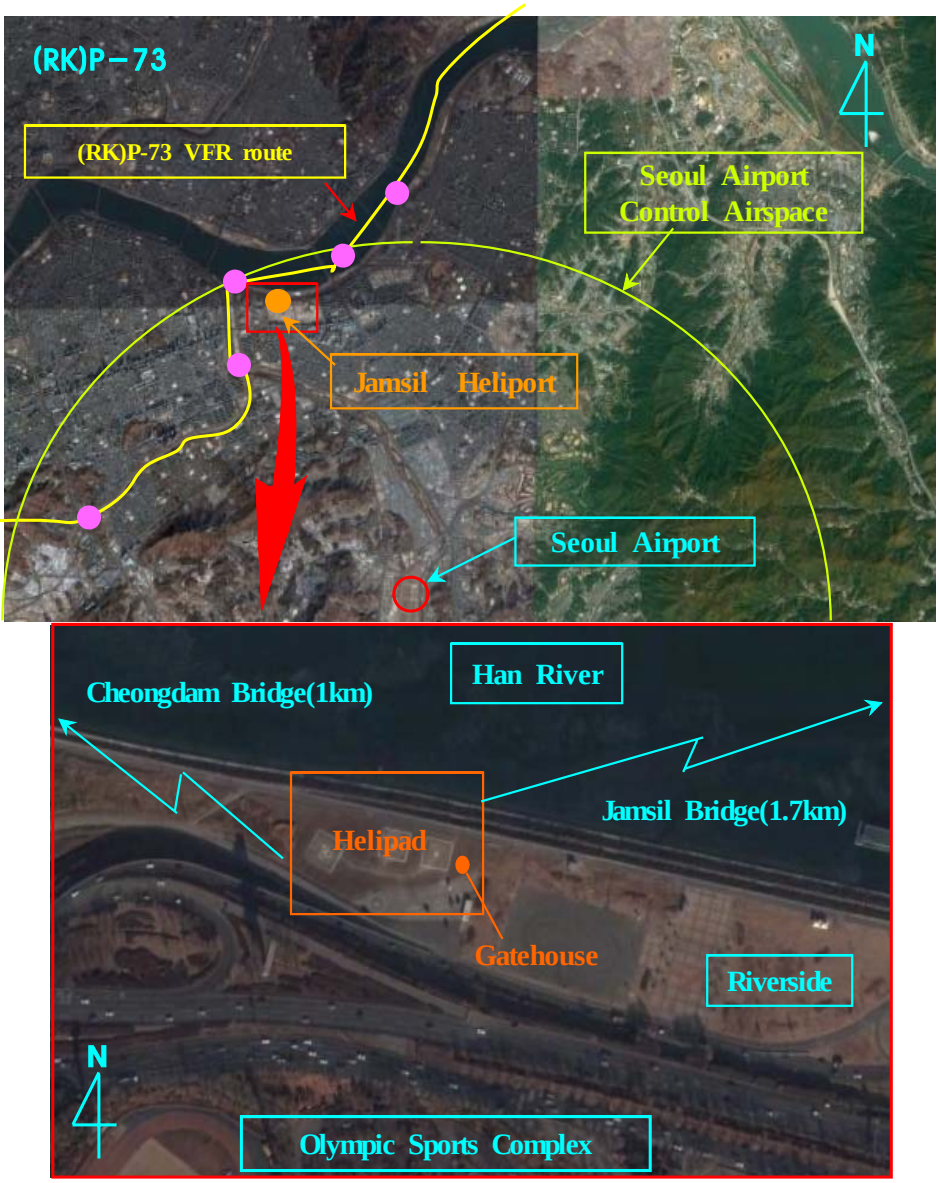
47) E 127° 04′ 27.477″ N 37° 30′ 59.25″

48) A level-upped riverside which is sunk only when the water level is high during the rainy season is located north of the Olympic Sports Complex.

49) A heliport with a width of 15 cm or more and a length of 15～40m (Enforcement Regulations Attached Table 2)

50) Total seven companies including Samsung, SKT, LG, Hyundai Motor, Hanwha, Posco, and the Missionary



[Photo 6] Overview of Jamsil Heliport

1.10.2 Cheongsim Hospital Heliport: RKBC

According to the Seoul Regional Aviation Administration Notice No. 2007-18, the administrative area address of the Hospital Heliport is San 52-2/3, Songsan-ri, Seolak-myeon, Gapyeong-gun, Gyeonngi-do[51], its installation permit was obtained on 5 June 2007 as Land Heliport Class D[52] and was put into service on 30 July 2007.

51) E 127° 32′ 20.02″, N 37° 40′ 54.04″

52) The length and width of the landing area are more than 1.2 times of the landing helicopter with a size more than at least 15m.

The surface of the heliport is paved with concrete, its elevation 167 m (550 ft), and the size of pavement is 60m wide and 30m long. The heliport has several installations, such as a heliport lighthouse, wind direction light, landing area perimeter light, etc. There are 24 landing area perimeter lights[53] installed along the surface area boundary of the landing area, and one wind direction light[54] is installed at the southeast corner of the landing area which is the location of the wind direction indicator[55], and the heliport lighthouse is installed on the rooftop of the hangar.

The highest peak of the Janglak Mountain, located southeast of the heliport, is formed lengthily south to north in a ridge form, and the heliport is located on the west side of the Janglak Mountain ridge. Since the terrain around the heliport slopes upward from west to east, it is relatively easy to identify the heliport if the aircraft approaches form the west side.

[Photo 7] Cheongsim Hospital Heliport facilities

53) Flush type, halogen 55W, yellow omnidirectional floating lights (24 places)
54) Halogen 150W×4 lamps
55) fiber goods specification 2.8m(length)×0.7m(wide side diameter)×0.3m(narrow side diameter)

1.10.3 ATS to the HL9292

The section flown by HL9292 on the day of accident was to fly back and forth between approved heliports, and it does not require separate takeoff and landing clearance pursuant to the Aviation Act Article 53 (Place of takeoff and landing) and Enforcement Regulations of the same Act Article 168 (Application for takeoff and landing permission at a place other than an airfield).

The flight plan for the HL9292's flight of the day was lawfully submitted[56] to the Incheon FIC[57]. The flight plan submitted to the Incheon FIC and the actual flight are as shown in Table 3 below.

Flight section	Departure time		Flying time	Arrival time		Remarks
	Estimated	Actual		Estimated	Actual	
Cheongsim～Jamsil Heliport	12:00	12:10	20 min	12:20	13:31	
Jamsil～Cheong-sim Heliport	16:30	16:40	20 min	16:50	**17:12**	**Crash report**

[Table 3] HL9292's flight plan and actual flight

In order for HL9292 to take off from Jamsil Heliport and fly to the Hospital Heliport, it should communicate with Incheon FIC[58], MCRC[59] and Seoul Airport[60]. Accordingly, HL9292 made necessary contacts with the relevant agencies by phone and radio equiped on the aircraft.

1.11 Flight Recorders

The flight recorder installed on HL9292 is P&G MPFR[61], manufactured by Penny & Giles of the U. K. and it is a FDR/CVR monolithic type[62] and was retrieved from the site immediately after the accident. The retrieved flight recorder had an armored

56) Time at which the flight plan was submitted to Incheon FIC: 11:42 min (Cheongpyeong→Jamsil), 16:03 (Jamsil→Cheongpyeong)
57) FIC: Flight Information Center
58) Controls takeoff and landing of civil aircraft within its jurisdiction
59) Controls embarkation and debarkation of RK P-73 visual foight route
60) Controls the airspace within its jurisdiction including the Jamsil Heliport
61) MPFR: Multi-Purpose Flight Recorder
62) P/N: D51615-102, S/N: 69010-002

case and internal circuit board damaged severely by the impact and the fire, but the flight data memory element[63] remained intact.

Since the armored case of the flight recorder was severely damaged, it was transferred to the U. K. Air Accident Investigation Branch(AAIB) from 21 to 25 Jul 2008 to extract the memory element from the damaged flight recorder, and all the stored data was taken out.

The ARAIB provided all the copies of the data taken out from the flight recorder to the NTSB for fair and accurate accident investigation.

The ARAIB and NTSB made an independent analysis based on the data taken out and the ARAIB requested NTSB for a minute analysis on the portions judged[64] to have a possibility of abnormality and the ARAIB was notified by NTSB of the results of the minute analysis on 3 September 2008 and 9 July 2009.

1.11.1 Flight Data Recorder(FDR)

In the memory element of the flight data recorder installed on HL9292 were recorded flight data of the last 13 hours and 42 minutes and 20 seconds (49,340 seconds) immediately before the accident, and the ARAIB analyzed 47 flight parameters out of total 688 parameters that were taken out from the FDR.

Technical documents provided by Sikorsky Company of the United States were used to read the flight data recorded in the FDR of HL9292, and of the whole flight data, prior to the accident, the major parameter data of the last flight section (Jamsil Heliport →Cheongsim Hospital Heliport) was used.

The time of aircraft crash was received by the air traffic control agency, and 119 rescue team was recorded about 5 minutes earlier than the time when the recording ended in the FDR. Consequently, the time of radio communication with the Air Traffic Control Authority recorded in the CVR was synchronized[65] with the time of

63) First-written, first-removed method, 64 words per second
64) FDR 2 places: delayed reaction to the movement of control column, CVR 2 places: metallic noise 2 places
65) Time is recorded in the flight recorder of HL9292 in reference to the local time inputted by the pilot, so we made the flight recorder time agree with the control agency recording time.

communication recorded in the Air Traffic Control Authority. The ARAIB determined the crash time of HL9292 as 17:06:20.9 on the basis of the synchronized time.

1.11.2 Cockpit Voice Recorder

The recording data extracted from the CVR consisted of a total 6 files including 4 files of about 30 minutes long and 2 files of about 120 minutes long.

The details recorded in CVR are shown in Table 4 below.

File name	Data source	File size	Analysis bandwidth	Data length (hh:mm:ss)
CV 1	None (spare)	59.6Mb	4kHz	00:31:47.520
CV 2	ICS	57.8Mb	4kHz	00:30:49.540
CV 3	ICS	64.3Mb	4kHz	00:34:17.888
HQC	CAM	60.7Mb	8kHz	00:32:23.628
CVC	ICS	231.9Mb	4kHz	02:30:40.224
LQC	CAM	233.9Mb	4kHz	02:04:43.712

[Table 4] Details of CVR file recording

Abbreviations

CV: Cockpit Voice[66)]

HQC: High Quality Cockpit Area Mike[67)]

CVC: Cockpit Voice Combined[68)]

LQC: Low Quality Cockpit Area Mike[69)]

ICS: Inter-Communication System[70)]

CAM: Cockpit Area Mike[71)]

66) The channel (for short time) for recording voice signals inputted through the mike of the captain or co-pilot seat in the cockpit

67) The mike for recording voice signals generated from the whole of the cockpit; it records for a short time in high quality

68) The channel (for long time) for combined recording of voice signals inputted through the mike of the captain or co-pilot seat of the cockpit

69) The channel for recording for a long time in low quality the voice signals generated from the whole of the cockpit

70) A communication system between captain and co-pilot in the cockpit

71) The mike for recording voice signals generated from the whole of the cockpit

As shown in [Table 4], since all files are different in length, it was necessary to make the times of all files are consistent with each other based on the point of time of a specific incident[72] that are commonly agreed in the recording.

The ARAIB used this data to make the primary analysis. For a minute analysis of two abnormal noises[73] confirmed in this process, the ARAIB gave the CVR data to the NTSB, and NTSB gave the data to Sikorsky Company for a detailed voice analysis.

As a result, there was no way to confirm the exact source and kind of abnormal noises since there was no sound source in the manufacturer sound data that correspond to them.

1.12 Wreckage and Impact Information

1.12.1 General Description

The crash site is a terrain sloping upward at about 10 degrees with dense growth of pine trees of about 20 to 25 years old and scrub. The ground impact marks and the distribution of wreckage were investigated to find traces of the aircraft impacting on trees initially at a point 162 m in the direction of 300 degrees from the crash site of HL9292 as shown in [Photo 8].

The main trace of crash was formed as trees were cut in an area about 112 m long and about 30 m wide from a point of about 50 m in the direction of 120 degrees from the initial position of contact with trees.

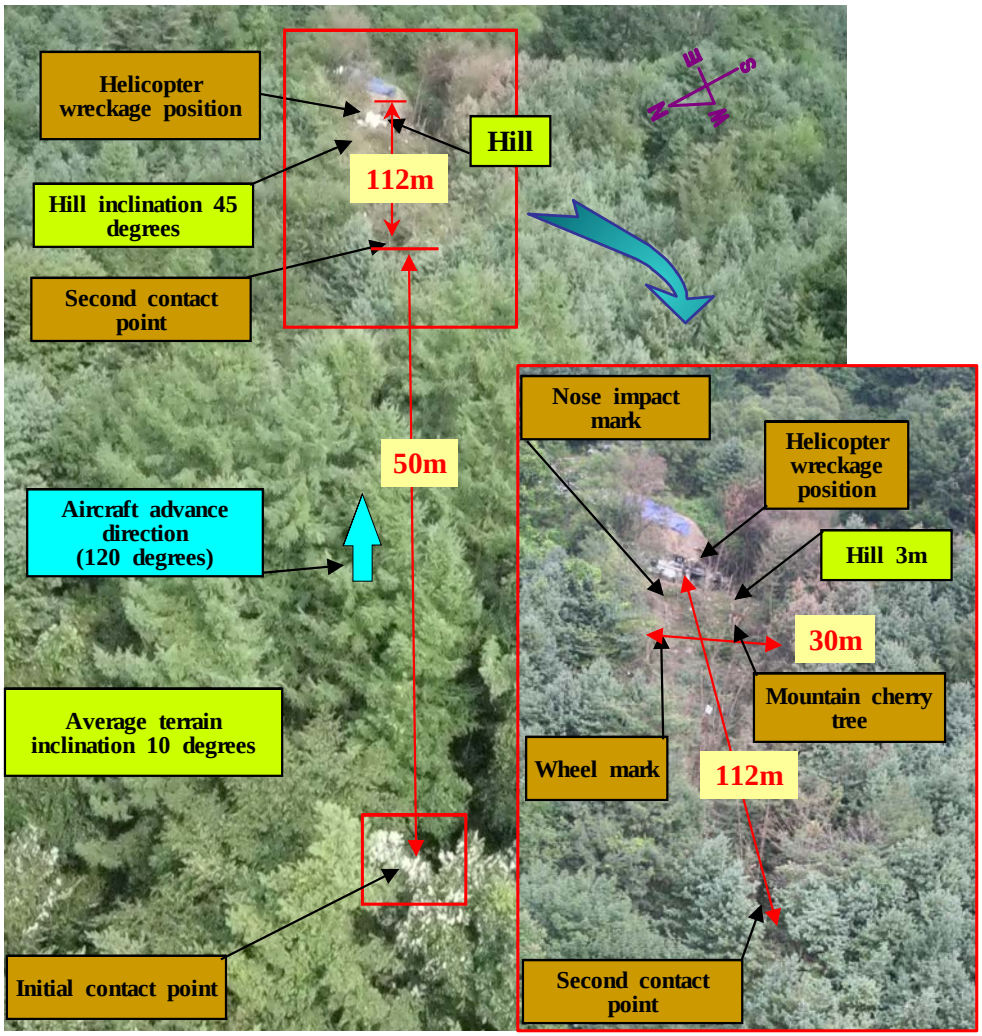
On the right of the point 35m in the direction of 300 degrees from the wreckage position, there were traces generated when the left wheel of HL9292 impacted on the ground. On the front slope of a hill (with reference to the helicopter forward direction) 3m wide and 3m high extending crossways immediately ahead of the wreckage position, there were traces of depression made when the left nose portion of the helicopter impacted.

Broken pieces of the fuselage cover of composite material were scattered along the

72) The initial impact noise at 34:15.318 of CV3 file
73) Sound judged to metallic noises recorded at 17:05:57.9 and 17:06:17.8

corridor where trees were cut, and most of the wreckage excluding the main rotor and tail rotor blades were concentrated on the crash site.

The cherry tree[74] which was 7m left in the direction of 300 degrees from the crash point was broken by four of main rotor blades impact. And the one of four blades was broken and lying beside the mountain cherry tree.



[Photo 8] Overview of the crash site

74) Age about 40～50 years, diameter about 30～40cm

1.12.2 Fuselage

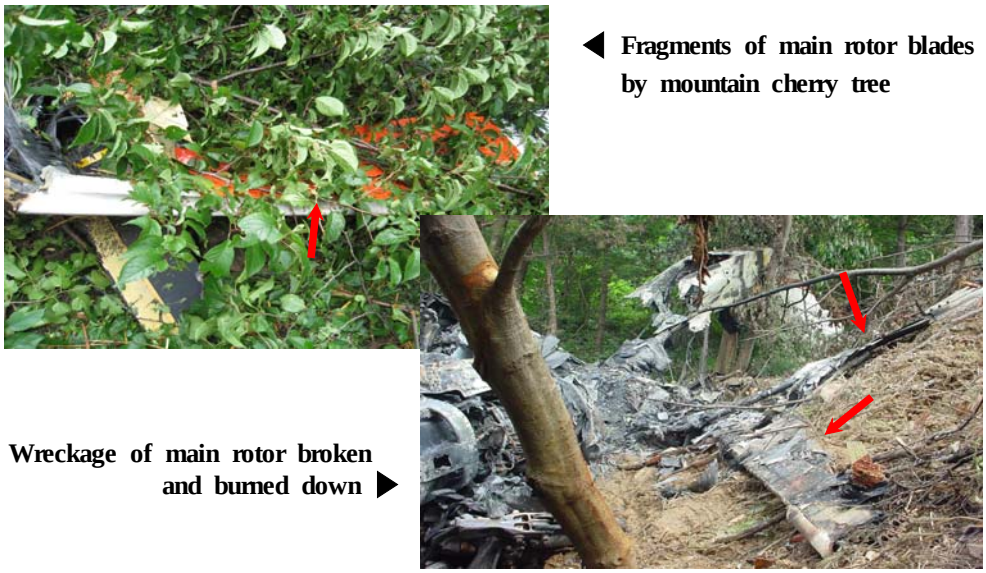
The fuselage caught a fire while it was overturned to the left. Except for the part of the left fuselage skin, the whole of it was burned down, so it was impossible to confirm the condition of each component part. [Photos 9 and 10] below show the fuselage portion that was burned down completely.

[Photo 9] The exterior of fuselage after fire

[Photo 10] The interior of fuselage after fire

1.12.3 Main Rotors

One of four main rotor blades was broken and dropped by the mountain cherry tree. The other three were dropped on the slope beside the fuselage. All the three had the tip cut, the root bent, remained stuck to the main rotor hub and damaged by fire. [Photo 11] below shows the damage to the main rotor blades.



[Photo 11] Damage to the main rotor

1.12.4 Engines

[Photo 12] Engine burnt down

The engine including the cowling was completely burned down by the fire to the extent that only its form was identifiable, and the exact firing point was not confirmed. [Photo 12] shows what happened to the engine.

1.12.5 Tail Boom

The tail boom had the middle portion cut and part of it separated from the front fuselage, and the tail rotor blades had the hub portion cut and separated.

The separated tail boom was not burnt despite the fire, and the vertical stabilizer was upside down 180 degrees and dropped to the ground.

[Photo 13] shows the damage to the tail boom and tail rotor blades.

◀ [Photo 13] Damage to tail boom and tail rotor blades

1.12.6 Cockpit and Cabin

The cockpit and cabin were completely destroyed by the fire, so it was impossible to confirm the condition of the instrument panel, the seat layout of the cabin, the mark of emergency exit, and the condition of the emergency light.

1.13 Medical and Pathological Information

1.13.1 Crew Information

The two pilots held valid airmen's medical certificates and no evidence of pathological factors or negative elements that could affect the pilot's ability to discharge their duty, was found.

1.13.2 Passenger Information

The passengers failed to take a defensive posture in preparation for a crash as they encountered an unexpected crash situation, and two of them did not fasten the seat belt.

Most of the passengers were severely impacted with the seat belt fastened and had the waist, chest, neck, etc. injured, and [Table 5] below describes the extent of injury of each passenger.

	Seat	Sex	Age	Injury	Extent of injury (Diagnosis)	Remarks
Cockpit	Right	Male	58	Lumbar vertebrae fractured, shoulder joint sprain, lower waist pain	S(14 weeks)	Captain
	Left	Male	41	Lower waist pain	M	Co-pilot
	15	Female	36	Shoulder joint sprain	M	On-board maintenance personnel
VIP room	1			Vacant		
	2			Vacant		
	3	Male	88	Waist hip pain	S(12 weeks)	
	4	Female	65	Lower waist pain	S(14 weeks)	

	Seat	Sex	Age	Injury	Extent of injury (Diagnosis)	Remarks
General cabIn	5	Male	59	Rib, sternum sprain	M	
	6	Female	52	Lower waist pain	M	
	7	Female	7	Chest pain, cervical vertebra sprain	M	
	7	Female	5	Lower waist pain	M	
	8	Male	61	Cervical vertebra, should joint sprain	M	
	9	Female	29	Backbone fracture (closed)	S(14 weeks)	
	10	Male	4	Lower waist pain	M	
	11	Male	51	Lower waist injured, abdomen contused	S(12 weeks)	
	12	Male	49	Cervical vertebra, lumbar vertebrae sprain, lower waist injured	M	
	13	Male	44	Lower waist injured	M	
	14	Male	65	Clavicle fracture, lower waist pain	S(12 weeks)	

[Table 5] injury to the persons on board

※ See [Fig. 6] for seating

※ S: Serious injury, M: Minor injury

1.14 Fire

On-site investigation did not discover any evidence that a fire broke out before HL9292 crashed. The vestiges of fire were confirmed at the location where HL9292 stopped eventually and the fire did not spread to the ground area around. [Photo 14] shows a fire breaking out.

At the accident site, it was raining continuously in a dense fog, and the fire fighting team started extinguishing work using surfactant and foam from about 17:21 and at about 17:50 the fire was completely extinguished, but most of the fuselage except the tail boom were burnt down completely as shown. [Refer to Photos 9, 10 and 13].

[Photo 14] Aircraft after the crash

1.15 Survival Aspects

1.15.1 General

The cockpit of HL9292 is composed of a captain seat[75] and co-pilot seat.[76] The cabin is divided into three sections from behind the cockpit to the tail of the cabin, and each section is divided by bulkhead.

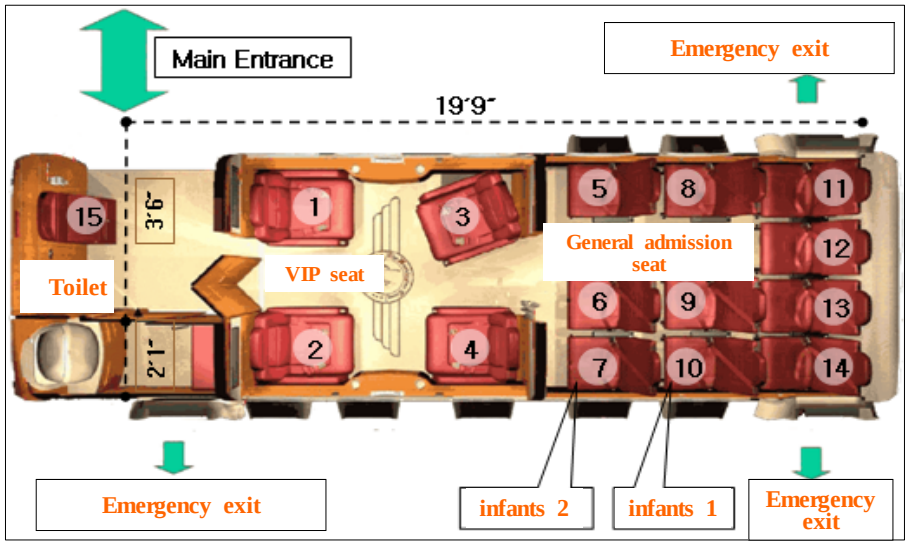
As is shown in [Fig. 6], the cabin has 15 seats, the front cabin has a main entrance and a seat for an on-board maintenance personnel (⑮), a lavatory and an emergency exit, the middle cabin is a VIP room with four seats (①,②,③,④), the aft cabin is a general cabin with 10 seats, (⑤～⑭) and an emergency exit each on the left and right in the back.

Of all the seats, the seat for the on-board maintenance personnel (⑮) and the seats (①,②) in the front of the VIP room are installed facing backward and the rest of the seats are facing forward.

75) Right cockpit seat (facing the nose)
76) Left cockpit seat (facing the nose)

HL9292 has three emergency exits in addition to the cockpit entrance and the main entrance however, none of the emergency exits were used[77] during the evacuation of the passengers.

[Fig. 6] shows the layout of the cabin seats and the location of emergency exits.



[Fig. 6] Cabin seat layout and location of emergency exits

1.15.2 Passenger Statements

Of all 13 passengers who were on board in the cabin, the ARAIB obtained statements from eight passengers[78] including the on-board maintenance personnel.

According to the passenger statements, they were not informed of such safety procedures after boarding: the location of the emergency exits and their usage-how to open and close, how to make emergency evacuation, and a proper way of using a seat belt or other emergency equipment[79].

And when they departed from Jamsil Heliport, it was raining but the visibility was

77) As HL9292 was overturned to left, the two left emergency exits were in contact with the ground, and the passenger on seat 11 unfastened the seat belt and came down to the floor to try to open the right emergency exit but failed because the indoors was dark and he could not reach it by hand.

78) With reference to the seat numbers of [Fig. 3], the passengers on seats ⑤, ⑥, ⑧, ⑨, ⑪, ⑬, ⑭ and ⑮

79) First aid medication, first aid kit, emergency equipment (signal prominence, flash, strobe light, fire extinguisher, etc.)

good, and they could see outside terrain through the cabin windows during flight. According to the statements of the passengers who were on seats ⑧ and ⑭, when passing the Cheonpyeong Bridge, there was a fog on the ground, and when passing the Cheongsim International Hospital, they could see the Zenith Palace[80]. However, because of the cloud cover, they could not see anything after releasing the landing gear for landing.

According to the statement by the on-board maintenance personnel, he opened the lavatory door to watch outside as the helicopter approached for landing, and he could identify the building of the Cheongsim International Hospital from above and the helicopter was in clouds.

And after hearing the co-pilot saying "it is low" and then "it has passed," the on-board maintenance personnel felt the nose of the helicopter was being lifted up. After a minute, he saw something passing outside the window, and then the helicopter crashed with a huge crashing sound.

According to the statements by most of the passengers, the inside of the helicopter was dark without any light; however, after noticing a light from the exit, each passenger moved toward the exit to escape.

According to the statements by the passengers on seats ⑧ and ⑨, they had hard time breathing because the cabin was filled with smoke when they tried to escape and witnessed flames were spreading from the back of the helicopter.

1.15.3 Fire Fighting and Rescue Activities

Notified of the helicopter accident from the co-pilot on the day of accident at about 17:08, the operation room of the Gyeonggi Fire Services notified the Gapyeong Fire Station immediately. On receiving the situation report, the Gapyeong Fire Station ordered the Flood Disaster Rescue Teams and Regional Rescue Team under its jurisdiction (Seolak, Cheongpyeong, Sangmyeon, Hamyeon and Bukmyeon) to move and notified relevant agencies[81].

80) A group of buildings located about 750 m from the Cheongsim International Hospital Heliport toward the peak (east) of Janglak Mountain; they are located about 100 m higher in elevation than the heliport.

On receiving the order to move, the Flood Disaster Rescue Teams and the Regional Rescue Teams left their posts for the site of the accident. As soon as they arrived at the site, they started rescuing peoples and fire fighting activities. [Table 6] below shows the mobilized personnel and equipments status for each rescue squad.

Classification	Mobilization time	Arrived at the site	Mobilized personnel	Mobilized equipment	Distance to the site
Gapyeong Station 119 Rescue Team, Flood Disaster Rescue Teams	17:08	17 : 39	15	Command car, pump, tank, ambulance, silver ambulance, Bendy, elevated construction, chemical, supporting, investigation, carrying rescue equipment, etc.	16.3km
Seolak	17:08	17 : 21	3	Pump car 2, Ambulance 1	4km
Cheongpyeong	17:08	Around 17:35	3	Pump car 1, Ambulance 1	13.7km
Sangmyeon	17:08	Around 17:45	1	Tank car 1	21.3km

[Table 6] Gapyeong Fire Station mobilized personnel and equipments

All the passengers had escaped before the rescue team arrived at the site and were waiting in the forest[82], and the initial members of the rescue team could not find out the location of the passengers so there was some delay in time finding them out.

It was not long before the rescue team members found out the passengers who had escaped and transported them to the emergency room of Cheongsim International Hospital which is located about 6-minute walk from the crash site, and it took about one hour and ten minutes to finish the rescue works.

By the time the fire extinguishing team arrived at the site, the peak of fire had passed, so it was possible to extinguish it relatively easily.

Surfactant and foam were used to extinguish the fire, and it took 29 minutes from 17:21 to 17:50 to extinguish the fire completely. And while they were saving lives and

81) Wire notification to the situation room of Gapyeong-gun Office, Gapyeong Police Station, Army 66th Division and emergency call-up of volunteer fire department

82) In the forest about 100 m southwest from the crash point.

extinguishing the fire, the accident site was under control by the Chief of Gapyeong Fire Station.

1.15.4 Survival Affection Factors

The fuselage of the helicopter was burned almost completely and identifiable wreckage of the interior was almost lost, so it was impossible to find out the factors that affected survival based on the wreckage. Therefore, survival affection factors were investigated on the basis of the statements of the passengers.

During the flight from Jamsil Heliport to the destination Hospital Heliport, no passengers had recognized or confirmed any warning light, warning sound, abnormal vibration or smell.

The passengers, who encountered an unexpected crash situation, could not take any postures in preparation for impact. After the crash, there were no flight crew's instructions for evacuation, and the flight crew members and the on-board maintenance personnel had never received any emergency evacuation training.

Most passengers including the captain were injured, so if evacuation had been delayed, their lives would have been in danger. However, some of the passengers naturally volunteered to help each other escapefrom danger, so it was possible to prevent additional harm.

Immediately after HL9292 crashed, the frame of HL9292 fuselage was not damaged, the seats were not separated or damaged, and the safety belts were not cut or loosened. It was difficult to unfasten the buckles hanging from the seat because the helicopter was overturned 90 degrees left. However, except the infants, all the passengers were able to unfasten their seatbelts by themselves.

No guardians of the infants were designated before boarding, and four passenger s[83] lost consciousness due to the crash impact but recovered consciousness hearing the infants cry, At the moment, the inside of the cabin was dark and the emergency light was not on.

83) Passengers on seats ⑧, ⑪, ⑭ and ⑮

The on-board maintenance personnel who was sitting on the auxiliary seat (⑮) of the main entrance recovered consciousness and opened the main entrance to be the first to escape when he witnessed the fire breaking out in the No. 1 engine portion.

Subsequently the co-pilot and all passengers escaped through the opened main entrance. One (⑨) of the passengers who wore glasses had lost her glasses at the time of the crash impact so she could not see ahead because of the dark indoors and her weak vision. But looking at the light coming through the opened entrance and helped by others, she was able to escape.

After the main entrance was opened, the passenger on seat ⑤ and ⑬ played the role of pushing up the other passengers inside the helicopter, and the passenger on seat ⑪ played the role of pulling other passengers on the helicopter. On the ground outside of the helicopter, the co-pilot, the on-board maintenance personnel (on seat ⑮) and the passenger on the seat ⑭ helped the passengers to come down and escape from the helicopter fuselage.

Such a natural division of role enabled quick evacuation before the fire spread to the whole of the helicopter, but there were passengers who felt pain in their chest because toxic gases had already flowed into the aircraft.

The passenger who was sitting on seat ⑪ by the emergency exit decided not to open the emergency exit because it was not possible to reach it by hand. So, he escaped using the main entrance which was opened at that time.

The main entrance door is 176 cm[84] high from the floor, and the height of the lavatory door that is below the entrance is 63.5cm. It was possible to use the lavatory door as a foothold; therefore, evacuation was relatively easy, which contributed to reducing the evacuation time.

The passengers witnessed a fire breaking out from the engine of the helicopter and escaped to available open space about 4～5m off toward the front of the helicopter which was in the opposite direction of the fire. After that, they stayed away from the heat of the fire and moved to a safe place, more than 100m off from the helicopter, helped the injured each other and waited for the rescue team to arrive. Then they were

84) The fuselage was overturned to the left, so this means the height from the left side of fuselage to the entrance door.

transported to the Cheongsim International Hospital by ambulances.

1.15.5 Signs of Emergency Exit

HL9292 was totally destroyed by fire after the crash so it was not possible one verify to all the signs of emergency escape attached on the inside of the aircraft.

When compared the safety information card[85] submitted by the Tong-il Aviation and the safety information card by Sikorsky Company, along with actual aircraft[86] of Sikorsky, there were some noticeable discrepancies. The description of emergency exits with different shapes and some essential points were missing in the safety information card prepared by the Tong-il Aviation. Also, the shape and the position of the emergency exit handles were manufactured differently from the actual ones.

1.15.6 Emergency Exit Door Handles

When the interior of HL9292 was remodeled[87], a cover was installed over the open-and-shut handle. Because of this, it not only became difficult to use the open-and-shut handle, but also it was manufactured unsatisfactorily, for example, the explanation for the separation that is attached beside the cover was in English only.

[Photo 15] shows a comparison between the original form at the time of the manufacture, the form when the cover was installed after remodeling, and the form when the cover was removed.

85) Safety Information: Information for safe travel; a pamphlet of accordion type made by the Tong-il Aviation in which are recorded guidelines for action in an emergency situation of S92 such as how to open and close the emergency exit and how to escape; it is used a safety information card for passengers.

86) An helicopter of the same type as HL9292 provided to KAIB investigator by Sikorsky Co. for accident investigation

87) The interior was remodeled by Keystone Co., an affiliate company of Sikorsky Co.

[Photo 15] Open-and-shut handle and cover of the remodeled emergency exit

1.15.7 Activation of ELT

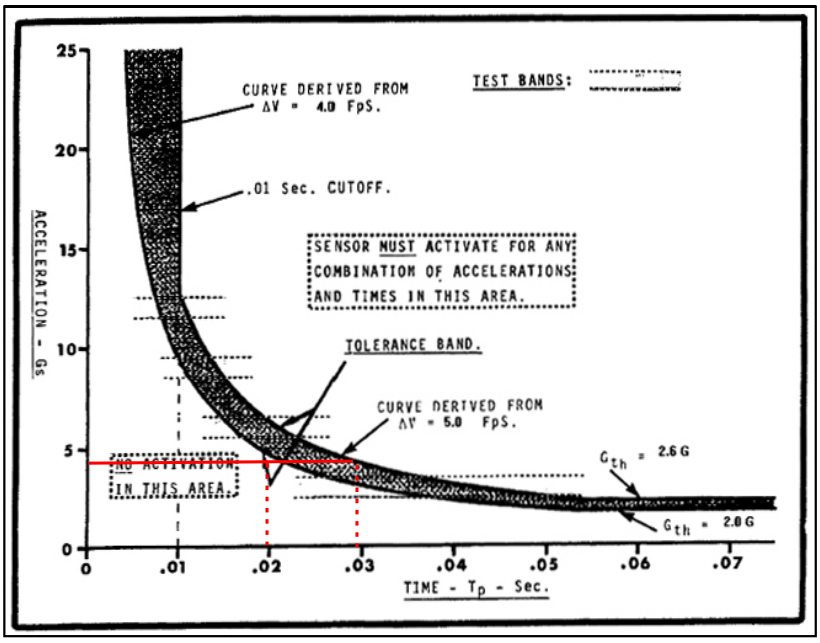
The ELT[88] of HL9292 was totally destroyed by the fire at the time of the accident so there was no way to recover it. As an external impact force affecting the activation of ELT, the value of vertical acceleration recorded in FDR for the very last was 4.72G.

The ELT installed on HL9292 transmits aircraft information[89] to the satellite for 24 hours on outgoing frequencies[90] when conditions[91] illustrated on the graph of [Fig. 7] below are created.

The information on the crashed aircraft transmitted from the ELT through a satellite was to be received by the Search and Rescue Division, Security and Safety Bureau, Republic of Korea Coast Guard and forwarded to the relevant agencies, but after the crash of HL9292, the ELT signals were not received by the Search and Rescue Division.

To investigate a possibility of preflight malfunction of the ELT, the status of periodical check of ELT by the maintenance people of the Missionary was examined, As a result, they did[92] the yearly check in accordance with the relevant maintenance manual, and at such times no abnormalities of the equipment were discovered.

88) A system for transmitting the location of aircraft distress; it emits emergency frequency automatically by impact; manufactured by ARTEX, model number: C-406-N HM,
89) Codifies and transmits the aircraft ID, registration code, registration country ID and aircraft location
90) Outgoing frequencies: 121.5Mhz, 243.0Mhz, 406.0Mhz simultaneously
91) Continue for 0.02～0.03 seconds by impact of 4.7G
92) Did operation check two times after introduction (May 24, ‘07 .and May 7, ’08. 5. 7.)



[Fig. 7] HL9292 ELT activation condition graph

The management status of ELT reception equipment of the Search and Rescue Section of Korea Coast Guard was checked. The reception list had ELT reception records for 17th and 20th, two days before the accident, but there were no receptions recorded on the day of accident, and there were no malfunctions recorded in the daily check log on the day before and the day of the accident of HL9292.

1.16 Tests and Research

There were no extra tests and/or analysis for investigation of this accident.

1.17 Organizational and Management Information

1.17.1 General

The Missionary is a religious group and did not have extra organization for operating aircraft. Therefore, the Missionary had signed an "Agreement for Commissioned Management of Private Helicopter Operation"[93] (hereinafter referred to as

93) An agreement concluded between the Missionary and the Tong-il Aviation for operation of HL9292

"Agreement") with the Tong-il Aviation and for all items necessary for operation of HL9292, it commissioned management to the Tong-il Aviation.

Based on this Agreement, the Missionary made "S92 Operation Manual"[94] (hereinafter referred to as "Operation Manual") and the Tong-il Aviation was to manage HL9292 in accordance with the standards and procedures provided by this Operation Manual.

The contents of commissioned management specified in Operations Manual 2-2 (Commissioning of work) are flight operations (pilots, flight dispatch, flight operation, etc.), maintenance (flight maintenance, maintenance management), outsourcing of maintenance (commissioning of maintenance that exceeds the ability of the maintenance work), ground support (aircraft fueling, taxiing and vehicles moving in apron, etc.)

Therefore, this report describes factual information related to flight management and maintenance management of the Tong-il Aviation based on the above Agreement and Operations Manual.

1.17.2 Flight Operations Management

The actual state of the flight operation management of the Tong-il Aviation was examined to ascertain the decision making process of pushing ahead with the flight mission despite that the weather on the day of the accident was not good for flight.

The Operations Manual 2-1 (Operation system) of the Missionary clearly specifies that the Secretariat/Chief Aide Office with authority delegated by the Missionary has overall control over the management and control of HL9292 and the Tong-il Aviation, the commissioned company, and is in charge of aircraft operation support and management.

The Operations Manual 3-2 (The flow chart of step-by-step work processing) provides that when the aircraft operation plan is decided by the Aide Office, this is notified[95] to the Tong-il Aviation, which analyzes all items related to flight operation,

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aircraft; it was prepared in July 2006 and signed by the representatives of the two.

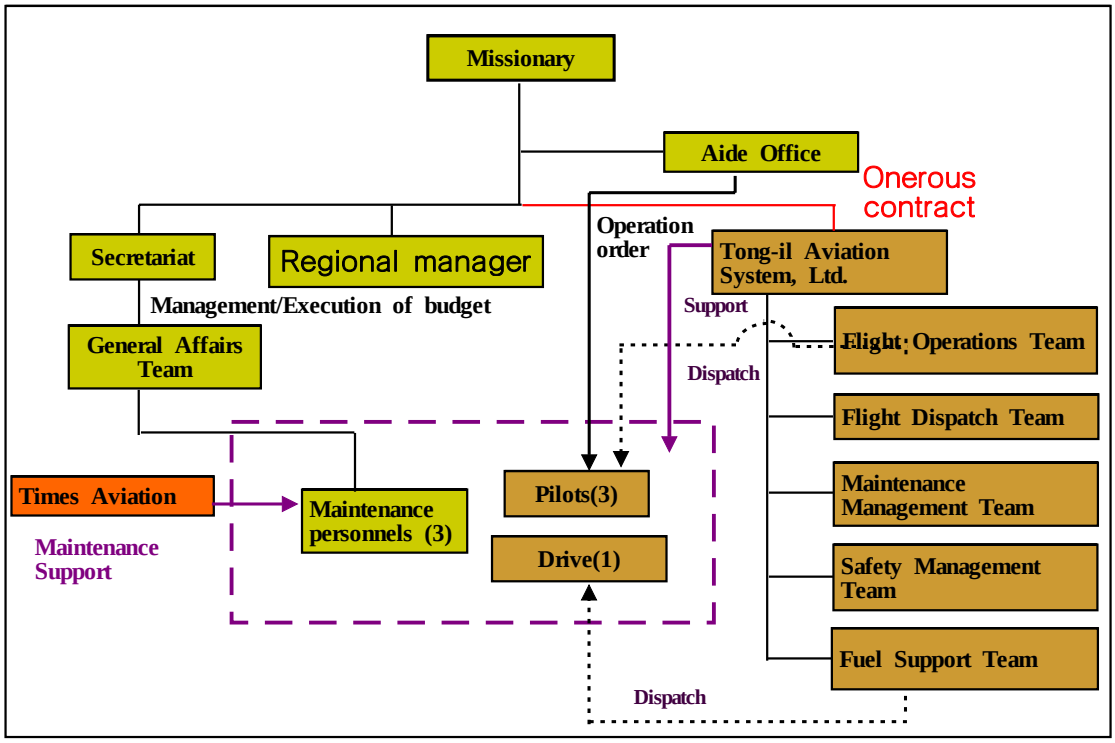
94) First established on July 25, 2006; amended on May 26, 2008.

95) Nationwide event: one month before, regular flight operation area: 7 days before, Yeosu/Yongpyeong/Cheongpyeong/Seonmundai areas of the regular flight operation area: three hours

maintenance, safety and fueling and then notifies the results to the Aide Office.

Then the Aide Office finalizes changes or cancels flight based on the contents related to flight operation reported by the Tong-il Aviation. When a final decision is made on a flight operation, the Tong-il Aviation is to take necessary action for support to the mission by area (flight operation, maintenance, safety and fueling).

As shown in [Fig. 8], three pilots who are permanently dispatched from the Tong-il Aviation flight operation team for operation of HL9292, three maintenance personnels, a tanker dispatched from the fueling support team and one driver make the private aircraft operation team dedicated to the flight mission of the Missionary.



[Fig. 8] Flow chart of actual operation of and support for HL9292

The HL9292 pilot received the flight order directly from the Aide Office of the Missionary. A pilot who receives a flight mission order checks[96] the weather of the mission area and completes preflight check and makes the flight plan and personally submits it to the relevant agency.

before

96) The internet in the pilot quarters or personal mobile phone were used to check the homepage of Korea Meteorological Administration or ask the organization providing weather information

When all preparations for flight are made, the pilot performs the flight mission of the day according to the flight plan. The pilot who has completed the flight of the day makes a flight completion report to the air traffic control agency and makes a "flight operation result report" and reports it to the Tong-il Aviation to terminate the relevant flight mission.

The captain testified that he made the decision on the flight mission based solely on his own judgment on the day of the accident. The person in charge of flight operations of the Tong-il Aviation testified that HL9292 is a private aircraft so it is operated differently from the aircraft owned by the Tong-il Aviation, and the final decision on flight mission is made by the pilot, so he did not make any limitation on the flight due to bad weather.

He also testified that support in the area of flight dispatch for the HL9292 pilots was no more than "clearance for takeoff and landing on places other than the airfield," "provision of information on flight such as NOTAM" and "provision of information on weather.

Thus the HL9292 pilots have performed most flight missions independently on their own differently from the Operations Manual of the Missionary, and support from the Tong-il Aviation in the area of flight operation has been limited.

1.18 Additional Information

1.18.1 Captain's Testimony

The captain's testimony was conducted in a patient's room of the Cheongsim International Hospital two times: on 19 July 2008, the day of accident, and on 26 August 2008. Below are the main points of the testimony.

- ○ The captain personally had the control to approach from northwest to southeast of the Hospital Heliport.
- ○ The weather on the flight pass on the day of accident was visibility about 3 miles and the heliport was not seen well because clouds covered halfway up the mountain.
- ○ There were no abnormalities in the aircraft until before the occurrence of the accident.

○ He could not see the helipad well as I was approaching the helipad, so I continued to approach[97] thinking "It will be in sight if I keep going on."

1.18.2 Co-pilot's Testimony

The co-pilot's testimony was conducted in a patient's room of the Cheongsim International Hospital two times: on 19 July 2008, the day of accident, and on 20 July 2008. Below are the main points of the testimony.

○ He checked the weather of the day of accident by connecting to the aviation meteorological observatory on the internet. The weather He checked at the time was ceiling 1,500ft, cloudiness scattered cloud and visibility at 4,000ft.
○ He did not feel any abnormalities during preflight check or flight.
○ While the captain has the control, He watched outside and monitored the instruments.

1.18.3 On-board Maintenance personnel's Testimony

The on-board maintenance person's testimony was conducted in a patient's room of the Cheongsim International Hospital one time on 20 July 2008, and additional testimony was conducted by phone on 26 August. Below are the main point of the testimony.

○ In the afternoon while they are approaching the Hospital Heliport, he had the Cheongsim Hospital building in sight but the heliport was not in sight.
○ The captain said, "I will reduce the speed to 60 knots," while descending and soon they entered into clouds.
○ When he was helping passengers escape, there was a fire from No. 1 engine.

1.18.4 Training of Flight Procedures on Encountering a Poor Visibility

The HL9292 pilots were permanently dispatched to the Missionary Hospital Heliport

97) The captain modified the first testimony at the second testimony, stating that he could see the heliport well until about 200 m ahead during the final approach and after that it was covered by suddenly advancing clouds.

(RKBC), so only seasonal safety education was conducted under the responsibility of the captain according to the instruction[98], and their performance are maintained, However, it was not possible to confirm the instruction or performance of the regular education[99].

Refering to the instruction of the Tong-il Aviation, the captain conducted an education program for the two pilots and the three maintenance personnels on "Procedures of avoiding and overcoming bad weather" as part of "Safety education in preparation for summer time" in a lecture form in the hangar of the Hospital Heliport on from 17:00 to 18:00 on 23 May 2008.

The contents of "Procedures of avoiding and overcoming bad weather" are: not to rely 100% on forecast weather, procedures of overcoming bad weather before encountering it or on entering into clouds, meteorological conditions for visual flight, some items to note, and etc.

1.18.5 Aircraft Weight and Balance

The last fuel load of HL9292 was 4,700 lbs. (full tank) supplied at the Cheongsim Hospital Heliport on 18 July 2008, one day before the accident.

According to the "Weight and Balance Check List" signed by the captain on the day of accident, the weight of HL9292 before takeoff on the day was 25,948 lbs[100], and its center of gravity was at 349.91 inches.

Since HL9292 had no variable factors other than fuel consumption for flight immediately before the crash, the weight less 840 lbs. for fuel consumption was 25,108 lbs. and the center of gravity was at 349.51 inches.

Therefore, the weight and balance of HL9292 was within the limit of allowance from the time of takeoff to the time of the crash.

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98) An official paper of the Tong-il Aviation instructing all employees to prepare and carry out seasonal safety measures; usually the instruction is issued before the winter time, spring thaw and summer time arrives.

99) Education classified as flight school and ground school of pilot education and training courses as specified by the Tong-il Aviation Operations Manual.

100) Aircraft tare weight: 18,618 lbs, pilots: 340 lbs, fuel: 4,700 lbs, maintenance man seat: 170 lbs, passenger row 1: 270 lbs, passenger row 2: 310 lbs, passenger row 3: 450 lbs, passenger row 4: 480 lbs, passenger row 5: 510 lbs, cargo: 100 lbs, total 25,948 lbs.

1.18.6 Captain's and Co-pilot's Experience of Instrument Flight

In Aviation Act Article 2 (Definitions), Paragraph 23, "Instrument flight" is defined as "flying by relying on the instruments installed on the aircraft to measure the attitude, altitude and position of the aircraft." And in Article 2, Paragraph 24 of the same law, "Instrument flight rules" is defined as "flying by following the rules or instructions made by the Minister of Land, Transport and Maritime Affairs."

If a pilot intends to fly by instrument flight or instrument flight rules, he should obtain instrument flight certification pursuant to Aviation Act Article 34 (Instrument flight certification and pilot training certification). On the basis of the above, the captain and co-pilot lawfully obtained instrument flight certification.

For a pilot to maintain the instrument flight qualification, he should have an experience of doing instrument flight of six or more instrument approaches and six or more instrument flights (including simulator instrument flight) from the day when he intends to do instrument flight to six months before the day pursuant to Aviation Act Enforcement Regulations Article 141 (Experience of instrument flight).

According to the captain's and co-pilot's individual flying time record, the captain's and co-pilot's instrument flight time for the latest six months were recorded 9.8 hours (captain) and 8.5 hours (co-pilot), so it was confirmed that they were maintaining the instrument flight experience in terms of time pursuant to Aviation Act Enforcement Regulations Article 141 (Experience of instrument flight).

The captain's and co-pilot's latest instrument flight results were recorded in the individual flight time record, but excluding the instrument training flight on simulator conducted in a flight school of the United States (FSI). Other than that, there was no other evidence such as instrument flight as filed with the traffic control agency.

Therefore, it was necessary to check the content of the testimony, how the time of instrument flight was recorded in the captain's individual flight time register and how it had been calculated. The captain stated that he had counted in the attitude-flight with reference to the instruments of the helicopter regardless whether of weather conditions during a visual flight or the experience of flying by radar advisory of MCRC under visual flight condition.

2. Analysis

2.1 General

The credentials held by the HL9292 flight crew were adequate to the requirements of Republic of Korea Aviation Act and the Operational Regulation of the Missionary and had qualifications necessary for the flight operation. And they took a sufficient rest before the flight and any medical factors that could affect the flight were not found.

The HL9292 aircraft was lawfully registered in accordance with the procedures as provided by Republic of Korea Aviation Act, and had airworthiness certificate, operation limit designation, noise certificate and radio station permit and its flight operation was approved.

The aircraft weight and balance was within the specified limit. There was no evidence to show that the aircraft had faults in the control system, the power transmission system and the engines before the accident.

The co-pilot's prompt report of accident occurrence and passengers' voluntary division of roles helped the smooth evacuation, and the fire did not spread to the vicinity due to rainfall at the time of accident.

This analysis focus on the weather factors, operation factors, education and training factors, laws, regulations and procedures, survival factors, organization, and management factors.

2.2 Weather Factors

On the day of the accident, the Korean Peninsula was under an indirect influence of typhoon, known as Galmaegi. Because of the typhoon, the overall weather of the Korean Peninsula was low clouds during the day and continuing local rain showers.

And at the time when HL9292 was returning from the Jamsil Heliport to the Hospital Heliport, there was a strong rain cloud zone of 10～20 mm per hour in the south of the return flight path, and such a rain cloud zone was moving northeast but it did not directly cover the HL9292 departure point, flight path and destination.

Around 16:30, the Seoul Airport was positioned on the edge of a strong rain cloud zone and there was a rainfall of 11 mm per hour accompanied by a south wind of 5 kts/h and clouds were partially covering down to near the ground surface.

The weather on the flight path was local rainfalls with visibility partially under visual flight conditions, but it was concluded that flight of a rotorcraft was possible since the weather on the flight path was visibility of more than two miles and ceiling of about 1,000 m～1,500 m for the most part.

Before HL9292 departed from Jamsil Heliport, the weather at the Hospital Heliport was checked by the captain around 16:10[101], it was drizzle with visibility of about two miles.

However, the destination weather was occasional and intermittent rains and the heliport was covered with clouds from about 10 minutes before the scheduled landing. So, the visibility is judged to be less than 100 m.

2.3 Operation Factors

2.3.1 Flight Procedures Performed by HL9292

According to the recording of the cockpit voice recorder, the co-pilot was advised by the controller in the process of communication with the Seoul Airport Control Tower that the weather of the Seoul Airport was visibility of 1.5 miles and a misty rain. The captain instructed the co-pilot to tell "Here, it is OK," so the co-pilot responded, "Here, it is about 2.5 miles, and ceiling 1,000 ft..."

The Seoul Airport air traffic controller advised that he could not clear the aircraft to pass the airspace according to the rule because the weather was not in visual meteorological condition and instructed to fly outside of the base, and asked whether there was any problem with the flight, and the captain told the co-pilot to say, "No problem...", so the co-pilot replied to the controller, "No problem."

101) The time when the weather was checked finally with the worker at the front gate of the Missionary Museum

After that, the HL9292 flew to the Cheongpyeong Dam along the Han River at an altitude of 1,000 ft and speed of 90～130 kts. The content of the conversation between the captain and the co-pilot during the flight was mostly about the bad weather condition on the flight pass, hoping the weather of the Cheongsim Hospital Heliport to improve.

Considering the co-pilot's saying at 16:59:15, “Although it looks all covered up, I think we would have some portion cleared up. We'd better stop worrying," it is judged the pilots were flying vaguely hoping the weather to improve.

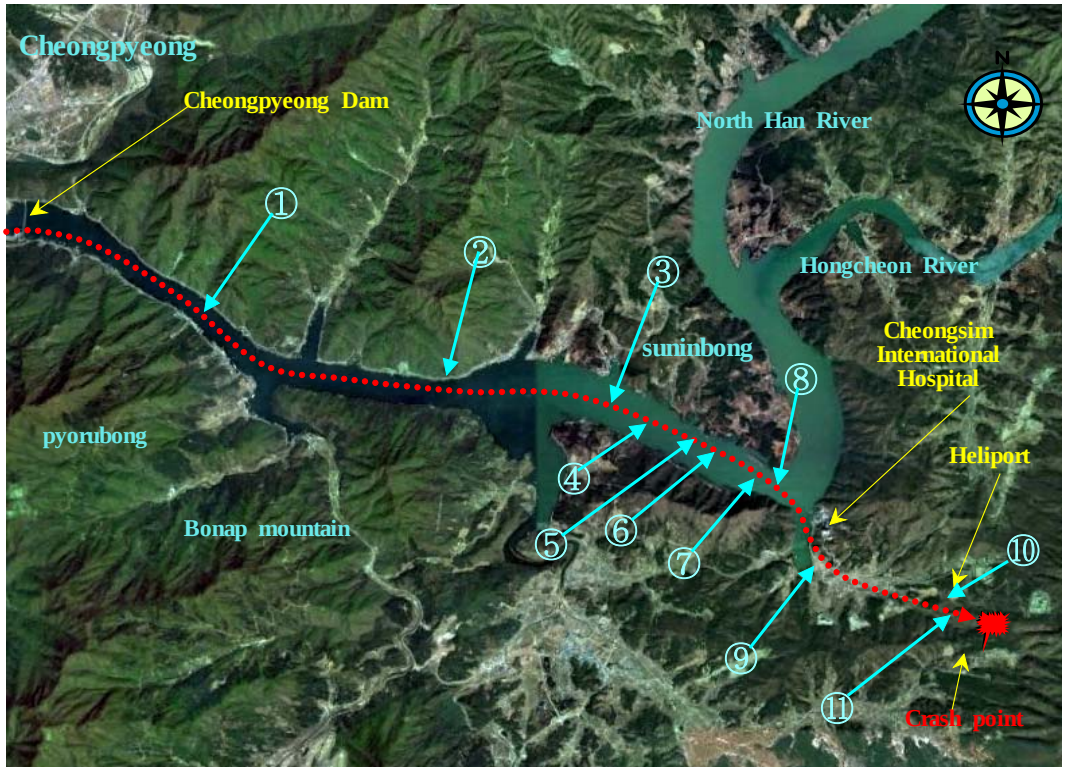
Thus, the captain and co-pilot pushed for flying despite that the weather was below visual flight conditions as specified in the Operations Manual of the Missionary from the time of departure and they were sufficiently aware of the fact that the weather of destination Hospital Heliport was not good.

According to the recording of the cockpit voice recorder, the pilots could see part of the Seonin Peak about 6 km ahead of the helicopter at point ① of [Photo 16] after passing the Cheongpyeong Dam and the Cheongsim International Hospital building at point ④.

But considering the statements of a passenger, "After the landing gear was down, I could not see anything because it was hidden behind clouds," and the statement by the on-board maintenance personnel, "After the captain said he would reduce the speed to 60 knots, the aircraft entered into clouds," it is judged that HL9292 entered into clouds at point ⑥ (about 3.4 km from the heliport).

While the aircraft was approaching the Hospital Heliport, the flight altitude was at or above 1,000 ft from point ① to point ⑤, and considering the elevation of the heliport was 550 ft, the pilots could have confirmed the heliport if the visibility had been good since there were no terrain higher than the flight altitude after passing the Bbyorubong (2,210 ft) and the Bonap Mountain.

But the captain asked the co-pilot eight times while he was flying from point ⑦ to point ⑩ whether co-pilot could have (the heliport) in sight, and the co-pilot replied intermittently he had not in sight. So there was no evidence that the pilots had confirmed the heliport even if momentarily.



Number	Time	Content	Speed(kts)	Altitude (ft MSL)
1	17:02:09.6	PIC: I can see a little of Seonin Peak, but...	101	1061
2	17:03:00	**Landing gear down**	95	1054
3	17:03:46.5	CP: Clear up, clear up..	82	1054
4	17:03:55.8	PIC: Let's go on a little further, we can see the hospital over there..	82	1047
5	17:04:13.0	CP: I can see Cheongsim Hospital.	81	1003
6	17:04:15	**Start reducing to 60 knots**	80	989
7	17:04:35.8	PIC: We should have pad in sight...	66	836
8	17:04:39.9	CP: Beacon light not in sight ... yet...	65	805
9	17:04:55.4	PIC: Ah～! I can't see it...	65	702
10	17:05:39.9	CP: Oh! we've passed it.	61	665
11	17:05:41.2	**Switch to manual control**	60	668

[Photo 16] Conversation between pilots on the final course and major actions taken

Considering the statements mentioned above and the statement in the captain's initial testimony, "I continued to approach judging I might see it if I keep going," it is judged HL9292 entered into low clouds from point ⑥ and continued to approach without the helipad and terrain in sight.

At 16:48:04, immediately before the contact with Seoul Tower, HL9292 connected to autopilot mode and at 17:05:41.2 (point ⑪), immediately after passing the Hospital

Heliport, it switched to manual mode. Therefore, the captain flew by auto pilot mode while descending to lower altitudes and reducing the speed to 61 kts from point ② to the moment when he passed the Hospital Heliport.

After passing the Heliport, the co-pilot advised the captain "Right turn! at 17:05:41.2 fearing that the helicopter would hit the mountain as shown in [Photo 17], and the captain started turning right from 17:05:42.

Also fearing collision with an obstacle, the captain abruptly increased power and maneuvered the nose up to climb, while the speed started to decrease sharply to "0" kts eventually at 17:05:53.

Confirming this, the co-pilot advised at 17:05:53.4, “Increase speed. Speed is 0 knots, sir." and at 17:05:56.4 advised "Heading 300," but the captain continued the climbing right turn[102)] at the same place while answering "OK!, OK! all right!"

As the captain continued to maintain the "0" kts and right turn, the co-pilot advised again "heading 300, speed 0 knots' at 17:06:02, and subsequently the captain lowered the pitch from 0.88 degrees to -26.92 in four seconds.

Accordingly, HL9292 had the speed increased from 0 kts to 91 kts and sank at a rate of descent of 3,591 ft/s and hit the ground about 6 seconds later.

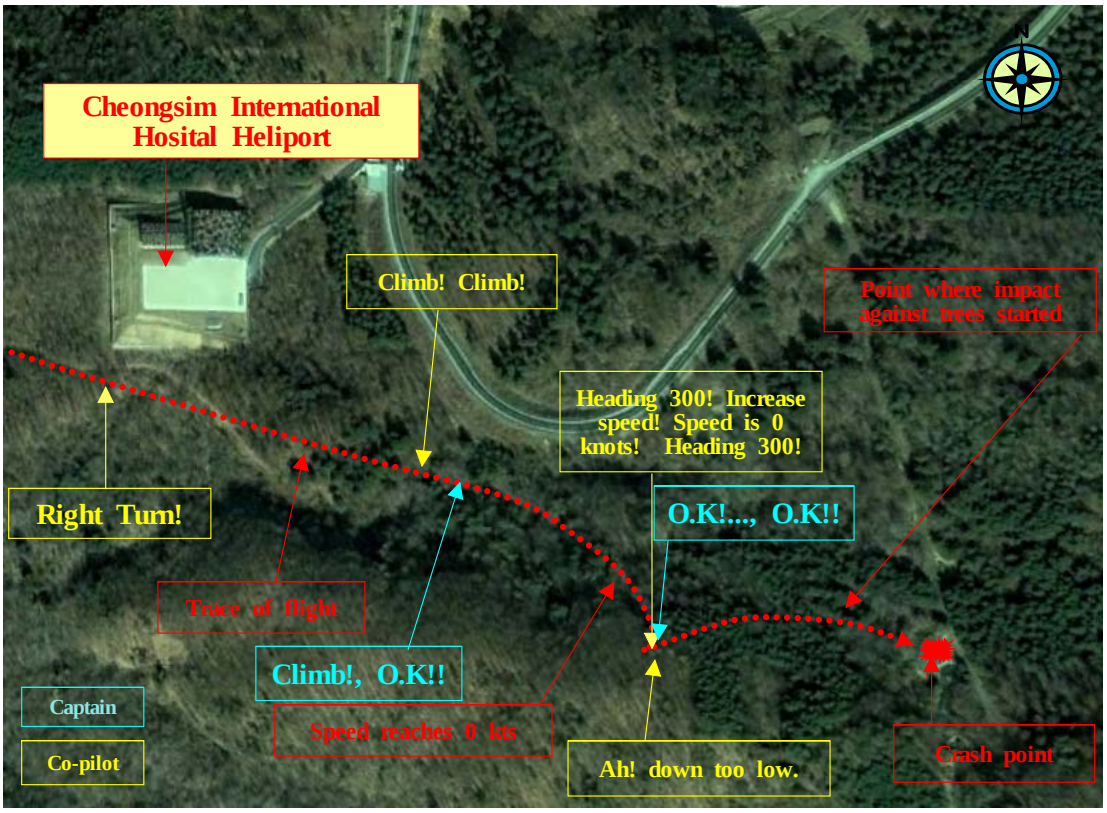
Thus, despite that it was not possible to identify the Hospital Heliport because it was covered with clouds, the captain approached in an autopilot mode without changing the landing place, returning or decreasing the speed sufficiently.

In addition, that HL9292 could not maintain the heading 300 degrees in clouds after passing the Hospital Heliport, that the speed was decreased to 0 kts, and that the pitch was excessively lowered to increase the helicopter speed, and that he failed to maintain the helicopter attitude without responding adequately to the co-pilot's advice are judged to be caused by a vertigo when he was in a panic as he failed to identify and the heliport and passed it.

Therefore, the ARAIB judged that this accident was caused by a combination of the

102) This is a phenomenon resulting from the fact that the captain abruptly raised the collective and failed to reduce by pedal the torque caused by power increase. It is judged to be related to his habit of flying mainly Eurocopter (the main rotor rotates inversely to S92) helicopters.

captain's inappropriate decision to fly under the bad weather condition, an unreasonable attempt to land despite the landing place was covered with clouds, approach in an autopilot mode without sufficient speed decrease to the Hospital Heliport in poor visibility and confirming the terrain, and an excessive maneuver and failure of attitude-flight in the process of go-around.



[Photo 17] Trace of flight in the final phase before the crash

2.3.2 Operation Management

The Missionary Operations Manual 12-1 specifies the duties of the person in charge of operation: checking the present weather and weather forecast of the flight pass, departure point and destination, checking and reviewing the operation information before flight, and providing operation information relevant to the decision to fly.

On the day of accident, the Korean Peninsula was positioned in a sphere of an indirect influence of typhoon, so the weather was low ceilings nationwide and rainfalls accompanied by local rain showers. So the situation required control of flight operations by analyzing the meteorological trends. .

However, on the day of the accident, the captain made a decision on the flight mission by himself after checking the weather information confirmed by the co-pilot on the internet, telephone, the current weather of the departure point, and destination. There was no way to confirm any evidence that anyone of the Tong-il Aviation advised the captain of the results of weather analysis when the captain made the decision of flight mission at the time.

Regarding such a result, the person who is in charge of the operation of the Tong-il Aviation stated that since HL9292 is a private aircraft and the captain is to make a final decision as to whether flight is possible or not the captain decided and carried out the flight mission.

And the Operations Manual provides that the person in charge of the operation of the Tong-il Aviation receives a flight mission from the Missionary and instructs the flight mission to the pilot and has him submit the flight plan, which he submits to the air traffic control agency.

However, differently from the Operations Manual, the pilot received the instruction of flight mission directly from the Missionary aide and the flight plan was submitted by the pilot to the air traffic control agency.

Considering the above facts, it is concluded the operational support of the Tong-il Aviation to HL9292 pilots was not adequate.

Although there are no specific limitations to the operation of a private aircraft in the current law, the Tong-il Aviation should have managed operation timely and properly by abiding by the onerous contract with the Missionary and the Operations Manual so that the pilots can effectively determine whether flight is possible or not and perform flight duties safely.

Therefore, the ARAIB concluded that adequate operation management and supervision were not provided the HL9292 pilots, so the accident could not prevented beforehand.

2.3.3 Cockpit Resources Management (CRM)

The co-pilot should perform duties instructed by the captain and some designated duties for flight mission and should be able to perform captain's duties in case the captain is in trouble during flight or give proper and timely advice for captain's safe flight.

However, the co-pilot of HL9292 merely assisted the captain. When reporting the weather to the captain, the co-pilot simply checked the weather over the telephone and through internet. Also, he had never suggested an impossibility of flight due to bad weather or given advice that could attract his attention.

And although he recognized that the captain was flying by autopilot while approaching the Hospital Heliport and making excessive maneuvers without maintaining attitude-flight after to manual control, he did not take any physical countermeasures.

The captain did not explain to the co-pilot the anticipated situation and actions to take on this despite he was aware of the possibility that the weather at the heliport would worsen.

And despite that the captain conducted a seasonal safety education for the co-pilot and the maintenance personnel, he did not abide by the procedures included in the contents of the education, and the co-pilot did not give appropriate advice on this either.

As a cause for this, it can be assumed that the difference in experience is too substantial between captain and co-pilot, and as a co-pilot who received transition training from the captain who was an instructor and a big senior of the military, he was daunted by the captain's authority, so it should be difficult to advise him against his intention or do manual maneuvers without the permission of the captain who had the control.

Such a problem should be considered in pilot formation to organize flight crew members with not so big a gap between captain and co-pilot so that safety advice is naturally given in flight and preventive measures are possible against unsafe factors, and efforts should be made so that such a trait is settled as a cultural affair.

Therefore, the ARAIB concluded that the cockpit resource management system of the Tong-il Aviation was not adequate, and because of this, the co-pilot did not give timely and appropriate advice to the captain when he made a decision on flight mission or he tried to make an unreasonable landing in poor visibility and also he could not play a proper role as a co-pilot in a situation where the captain failed in attitude-flight.

2.3.4 Maintaining Experience of Instrument Flight

After passing the Hospital Heliport, the captain of HL9292 failed to perform a proper attitude-flight in poor visibility, which led to an accident. But the attitude-flight using instruments can be said one of the basics of instrument flight.

Although the instrument flight time for the latest six months recorded in the individual flying time record of the HL9292 pilots is in conformity with the regulation as provided in Aviation Act Enforcement Regulations Article 141 (Experience of instrument flight), it is necessary to re-examine the adequacy of the calculation method of the remaining instrument flight time excluding the instrument training flight[103] by the simulated instrument flight system conducted in the flying school of the United States.

It is clearly stated in Aviation Act Article 70 (Air transportation work, etc.) Paragraph 1 that "Anyone who intends to move, take off, land or fly an aircraft in a control zone or control area of airfield should follow the sequence, time and method of moving, takeoff and landing as instructed by the Minister of Transport, Land and Maritime Affairs."

Therefore, in order to make an instrument flight in a control zone or area of airfield, the flight should be made by "instrument flight rules" as provided in Aviation Act Article 2 (Definitions) Paragraph 25, and flying by instrument flight rules means flying according to the method instructed on the flight pass instructed by the Minister of Transport, Land and Maritime Affairs.

So, it should be proper that the actual instrument flight time be calculated by a person qualified[104] for instrument flight by counting in the time flown after approval[105]

103) 5 days from July 7 to 11, 2008, PIC: 40h(ground school 20h, flight training 16h, briefing 4h), co-pilot: 42h(flying school 18h, other the same) ※simultaneously with instrument flight on flight simulator (including instrument approach 10 times)

104) A pilot who has obtained instrument flight qualification certificate and has type rating of the relevant

by the air traffic control agency using an approved aircraft[106].

If the captain made attitude-flight by referring to the instruments of the helicopter in the weather with poor visibility as stated in his testimony, or the experience of flying receiving radar advisory of MCRC in visual flight condition is counted in as instrument flight time, there is a problem whether we can judge such a flight as instrument flight and it cannot satisfy the requirement of 6 times or more as specified in Aviation Act Enforcement Regulations Article 141.

Therefore, to aim at safe flight by having pilots maintain actual experience of instrument flight, it is essential to clearly set the standard of counting in instrument flight time and the pilots should count in the result of flying according to this standard as instrument flight time, and if instrument flight was carried out, they should provide evidence by recording the name of facility approached and the time.

Only by doing so, it is possible to maintain the actual experience of instrument flight, and, it is not possible to prevent the decline in the skill of instrument flight due to perfunctory recording of instrument flight time but also utilize it for safe flight in an emergency.

Therefore, the ARAIB concluded that the cause that the HL9292 captain failed attitude-flight for a go-around after passing the Hospital Heliport is not unrelated to a lack of actual instrument flight training.

2.4 Training Factors

Since the HL9292 pilots were permanently dispatched from the Tong-il Aviation (Gimpo) to the Missionary (Cheongpyeong), it is difficult to conduct integrated training to satisfy the requirement of pilot training specified in the Operations Manual of the Tong-il Aviation. Actually Tong-il was managing the HL9292 pilots as private pilots.

Therefore, when the Tong-il Aviation orders "seasonal safety training", the dispatched

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type of aircraft and flight experience specified in Aviation Act Enforcement Regulations Article 141 (Experience of instrument flight)

105) When the air traffic control agency approves instrument flight, it designates the air route, altitude, etc.

106) An aircraft which is installed with instruments necessary for instrument flight specified in Aviation Act Enforcement Regulations Article 134 (Aeronautic instrument devices, etc.) and the Attached Table 22 and has instrument flight permitted in the Flight Manual.

pilots organize the instructors independently to conduct training. We could not confirm any evidence that they conducted education and training[107] other than commissioned education at a flying school of the United States

Despite the fact that they are the Tong-il Aviation's pilots, Tong-il Aviation has not conducted any additional training other than the commissioned education at the flying school in the United States. Another reason why they couldn't get training is they simply fly private aircrafts. Even the seasonal safety education was conducted perfunctorily on their own, so there was a problem that the contents of education were not applied to actual flight.

Although the flying skill training of the HL9292 pilots for the relevant type of aircraft may be sufficient with the commissioned education at the flying school of the United States, familiarization with and observance of various kinds of regulations and procedures (including CRM) should be possible through separate education and supervision. But the Tong-il Aviation failed to provide such education and supervision to the pilots.

Therefore, the ARAIB concluded that such an insufficiency of education could not contribute to quick and right decision on flight mission in bad weather, CRM for anticipation of risk and action to take, and effective performance of the overcoming procedures on encountering bad weather.

2.5 Law, Regulation and Procedure Factors

Although HL9292 was in operation as a private aircraft, it was a large rotorcraft with a maximum takeoff weight of 26,500 lbs. and most of its flight missions were airlift of more than 17 passengers.

As described in the factual Information, the Missionary concluded a contract of commission with the Tong-il Aviation regarding the operation (flight operation, maintenance, etc.), and the Missionary made the Operations Manual based on this contract and had the Tong-il Aviation abide by the Operations Manual to operate HL9292.

107) Excluding the initial and transition training of the co-pilot

But the Tong-il Aviation did not abide by the Operations Manual for the reason that HL9292 is a private aircraft and not only most of the businesses except takeoff and landing permits outside the airfield and cooperation with the relevant agencies were delegated to the dispatched pilot but also the education and training and management of pilots and supervision over flight operation were not sufficient.

In particular, Tong-il Aviation did not prepare a MEL based on the provision that the MEL specified in the current Flight Operations Technical Standard 1.1.1.4 and 8.1.6 (Definition of terms) is to be prepared by the transport business company and nor abided by the item that flight operation is not allowed in case of malfunction of EGPWS (audible alarm not working).

The ARAIB determined as a contributing factor the fact that the flight was made with the EGPWS not working based on the assumption that the accident could have been prevented if the EGPWS had been working normally since HL9292 was in a phase of go-around after passing the helipad at the time of the accident.

If there is an MMEL of the relevant type of aircraft, it will be reasonable to prepare and apply a MEL to all aircraft based on this so as to conform with the standard[108] as specified in the Flight Operation Technical Standard. Therefore, it is necessary to prepare a MEL that is ambiguously specified in the current Flight Operation Technical Standard and revise the enforcing principal so as to be applied to all aircraft provided with the MMEL.

The current aviation law does not contain pilot education and training and maintenance of qualifications and safety regulations such as crew emergency escape training and passenger safety briefing that are necessary for operating a large private rotorcraft (hereinafter referred to as "aircraft") like HL9292.

If we take a look at the character of mission of a recent medium or large private aircraft, it is operated similarly to a small transport business aircraft, but it applies significantly relaxed regulations, so it is deemed insufficient to be applied to a large private aircraft like HL9292.

108) When a MEL is prepared based on the MMEL provided by the manufacturer, the MEL should be equal to or more restrictive than the MMEL.

Therefore, it is necessary to prepare a safety standard and management scheme that conform with the current level and operation conditions of private aircraft including what is mentioned above as soon as possible in order to create conditions of safe operation of large private aircraft.

2.6 Survival Factors

Immediately after the accident, the ELT signals were not received at the Search and Rescue Section of Korea Coast Guard. Additional investigations were conducted to find out the cause of the accident, but possibility of malfunction was never found on the ELT reception equipment of the Search and Rescue Section of Korea Coast Guard. A maintenance person of the Missionary checked the operating condition of the ELT in the procedure and period specified in the related maintenance manual to find no abnormalities.

Therefore, it is necessary to examine the possibility that the impact force at the time of HL9292 crash that might not had reached the operation condition of ELT, and the possibility that the ELT antenna had been cut during crash so signals were not transmitted.

First of all, the value of vertical acceleration, which was recorded 4.72G on the last line of the HL9292 FDR, is judged to be not so reliable to use as a factor in the analysis.

Part of final numerical values recorded in the FDR are markedly false so that they cannot be used for analysis and they are the values that were recorded after the recording was missing for 3 seconds. Therefore, the values of vertical acceleration also cannot be said correct.

But considering that the speed of HL9292 was more than 80 kts at the time of the crash, it is difficult to say that the operation condition of ELT presented in [Fig. 7] was not satisfied. Therefore, the ARAIB assumed that the ELT antenna was damaged by the impact when HL9292 crashed and because of this, transmission of signals became impossible.

The indoor emergency light of HL9292 was to come on when the on-board

maintenance person turned on the emergency switch if the main power was normally supplied or was to be automatically turned on as auxiliary battery power is supplied if the main power was cut off. But it was not turned on after the crash.

According to the testimony by the on-board maintenance person, he did not turn on the emergency light switch after the crash, so if the main power was being supplied to the emergency light it would not be turned on, but if the main power was cut off during crash, it should have been turned on automatically.

Because the fuselage was burn down right after the crash of HL9292, it was not possible to confirm the exact cause.

And as problems shown by the testimonies by HL9292 passengers, the following problems were found from the accident investigation: that information on how to make an emergency escape and how to use the emergency escape equipment was not given; that one passenger tried to open the emergency exit but failed and the emergency exit open-and-shut handle cover is remodeled in such a way that it is not easy to identify and difficult to separate, so nobody used the emergency exit; that two infants were seated on one seat using a safety seat belt for adult; that no guardian was designated for infants before boarding the helicopter; that seat belts were not fastened during landing approach; and that the safety information card made by the Tong-il Aviation and utilized in HL9292 and the how-to-open-and-shut label attached on the emergency exit were unsatisfactorily made.

Although these facts did not affect the occurrence of the HL9292 accident, there were seriously injured persons after the accident, and the aircraft caught fire and toxic gases came into the dark indoors to make passengers' breathing difficult, and if the on-board maintenance personnel who had not fastened the seat belt had not regained consciousness after he had lost consciousness, there is a possibility of bringing about a large disaster.

As enumerated in the above, fast escape should be made in order to raise the survival rate of the passengers at the time of aircraft accident. For this, It is important to have the passengers familiarize beforehand with knowledge necessary for escape procedures in an emergency landing and the crew should be trained properly so as to conduct orderly and fast escape of passengers in an emergency.

And various instructions and information signs, emergency escape equipment, and

emergency exits should be managed and maintained in such a way that passengers and crew can be easily understood, identified and used to ensure fast and efficient escape in an emergency.

3. Conclusions

3.1 Findings

1. The credentials held by the HL9292 flight crew were adequate to the requirements of Republic of Korea Aviation Act and the Operational Regulation of the Missionary and had qualifications necessary for the flight operation.

2. The crew took a sufficient rest before the flight and any medical factors that could affect the flight were not found.

3. The HL9292 aircraft was lawfully registered in accordance with the procedures as provided by Republic of Korea Aviation Act, and had airworthiness certificate, operation limit designation, noise certificate and radio station permit and its flight operation was approved.

4. The aircraft weight and balance was within the specified limit. There was no evidence to show that the aircraft had faults in the control system, the power transmission system and the engines before the accident.

5. Despite that the Tong-il Aviation is an unscheduled air transport business company, it managed HL9292 differently from its own aircraft in operation management for the reason that HL9292 is a private aircraft, and because of this, it had supervision of operation, management of education and training, etc. managed unsatisfactorily by the dispatched pilots.

6. Despite that the captain was aware of the fact that the weather of the Hospital Heliport was unsuitable for visual flight, he did not explain to his co-pilot about the estimated situation and action procedures nor requested him to advise positively in case unsafe factors occur.

7. The Tong-il Aviation had a contract to operate HL9292 based on the Operations Manual prepared by the Missionary, but it operated flight operations and maintenance management differently from the Manual.

8. The pilot formation of HL9292 has an excessively big difference between captain and co-pilot, so it was an inadequate formation for proper cockpit resources management to be maintained.

9. The Tong-il Aviation has never conducted education of cockpit resources management (CRM) for the HL9292 pilots.

10. The current aviation regulations do not have provisions for the education and training of small and large private aircrafts[109] and maintaining their qualifications, passenger safety briefing, and crew emergency training.

11. In the current Flight Operation Technical Standard, the principal of preparing and enforcing the MEL is specified ambiguously.

12. The Tong-il Aviation has not conducted education and training on the escape procedures in an emergency for the pilots and on-board maintenance personnel, so they were not familiarized with the action procedures.

13. HL9292 did not apply the regulation relating to the EGPWS of MMEL (flight not permitted if it is not working).

14. It was assumed that the ELT antenna was damaged by the impact at the time of the accident of HL9292 and the transmission of ELT signals failed due to this reason.

15. The safety information card that was made by the Tong-il Aviation and was being used was improperly made for the use in HL9292.

16. The HL9292 passengers were not informed about how to open and close the emergency exit, location of emergency escape equipment and how to use it and how to escape in an emergency.

17. The indoor emergency light was not turned on at the time of the HL9292 crash, but the exact cause could not be confirmed because the fuselage was totally burnt down after crash.

18. In the cabin, two infants were seated on one seat and a safety belt for adult was used and a guardian for the infants was not designated.

109) Rotorcraft operated in this country (excluding the fixed-wing aircraft in operation of international flight)

19. The emergency exit of HL9292 was remodeled for interior decoration but the how-to-use label marked on the emergency exit and the emergency exit cover were not easy to identify, and the open-and-shut handle cover was remodeled in such a manner that is difficult to take it off.

20. The current Aviation Act and regulations do not clearly specify the standard of calculating the instrument flight time of the pilot.

3.2 Cause

The Aviation and Railway Accident Investigation Board determines that the probable cause of this accident was that despite that the flight crew could not visually identify the helipad because it was covered with clouds in bad weather conditions, they attempted to land unreasonably at a high speed in the autopilot mode and failed to maintain a proper flight attitude during the go-around, so they impacted on the ground.

Contributing to the accident were ①the flight mission was decided to be made in variable bad weather conditions, ②the co-pilot failed to give proper advice to the captain on the flight mission, en-route flight, final approach and the captain's improper decision and action in the go-around section after passing the helipad, and when the captain lost the flight attitude in a vertigo, he failed to take a proper defensive action, ③depite that the weather was not suitable for visual flight due to an indirect influence of typhoon, the Tong-il Aviation failed to provide the captain with positive operational support such as analyzing weather trends or recommending cancellation of the flight mission, and ④HL9292 was not applied with the specifications for EGPWS of the MMEL (flight is not allowed in case of its malfunction).

4. Safety Recommendations

As a results of its investigation of the accident of the rotorcraft (HL9292/S-92) owned by the Korea Family Federation Missionary for World Peace and Unification, the Aviation and Railway Accident Investigation Board makes the following safety recommendations:

To the Ministry of Land, Transport and Maritime Affairs (Office of Civil Aviation)

1. Complement and review laws and regulations relating to safety standards such as pilot education and training and maintenance of qualifications conforming with operation of medium and large private aircraft (rotorcraft), preparation and executing principal of MEL, flight crew emergency escape training and passenger safety briefing (AAR0801-1)

2. Complement and review pilot instrument flight time management guidelines and related regulations (AAR0801-2)
   A. Time flown after an instrument flight plan was submitted to and approved by an air traffic control agency
   B. Record and keep approach methods after instrument approach flight to airfield and related facilities and time

To the Korea Family Federation Missionary for World Peace and Unification

1. Revise and complement the section of flight operation management and education and training in the current Operations Manual so as to manage it at the management level of other pilots and aircraft belonging to Tong-il Aviation (AAR0801-3)

2. Strengthen supervision whether or not the Operations Manual of Tong-il Aviation is being observed (AAR0801-4)

3. Review and execute a scheme of providing the passengers with preflight safety

information (AAR0801-5)

To the Tong-il Aviation System, Ltd.

1. Abide by the Operations Manual prepared by the Missionary when operating the Missionary aircraft (AAR0801-6)

2. Operate the Missionary aircraft by applying the standards of MMEL provided by the manufacturer (AAR0801-7)

3. Strengthen operational supervision of the Missionary aircraft pilots and the cockpit resources management (CRM) (AAR0801-8)

4. Revise and complement the remodeled emergency exit how-to-open-and-shut label in such a way that it can be easily understood and identified (AAR0801-9)

5. Prohibit the act of seating two people on one seat of the cabin and prepare and use a safety belt for infant when boarding infants (AAR0801-10)

6. Make and furnish safety information cards for the Missionary aircraft in such a way that they conform to the aircraft structure and shape (AAR0801-11)

7. Make crew emergency escape procedures in an emergency and educate and train about them (AAR0801-12)