(AIRCRAFT ACCIDENT INVESTIGATION INTERIM REPORT)

JAPAN COAST GUARD

BOMBARDIER DHC-8-315, JA722A

and

JAPAN AIRLINES CO., LTD

AIRBUS A350-941, JA13XJ

December 25, 2024
By the Japan Transport Safety Board

The Japan Transport Safety Board (JTSB) has been conducting an investigation since January 2024 to determine the cause of the aircraft accident, a runway collision that occurred on January 2, 2024, at Haneda International Airport in Tokyo, Japan, involving a Bombardier DHC-8-315, JA722A, operated by Japan Coast Guard and an Airbus A350-941, JA13XJ, operated by Japan Airlines Co., Ltd. And the JTSB concludes that, based on the information obtained from the investigations so far, further fact-finding and analysis should be conducted, and that comments on the draft should be invited from the parties relevant to the cause of the accident and the States. It is expected that it will be difficult to complete this aircraft accident investigation within one year, therefore, in accordance with the Paragraph 4, Article 25, the Act for Establishment of the Japan Transport Safety Board, the JTSB reports the progress of the investigation as follows:

However, the contents of this interim report may be revised in the future as latest information becomes available.

In addition, this investigation has been conducted in accordance with the Act for the Establishment of the Japan Transport Safety Board and Annex 13 to the ICAO Convention on International Civil Aviation to determine the cause of the damage caused by the aircraft accident and to prevent future accidents and incidents and reduce the damage. It is not the purpose of this investigation to apportion blame or liability for this accident.

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The following abbreviations are used in this interim report:

AC	: Alternating Current
APU	: Auxiliary Power Unit
ATC	: Air Traffic Control
CDU	: Control Display Unit
CFR	: Code of Federal Regulations
CG	: Center of Gravity
CSMU	: Crash-Survivable Memory Unit
CVR	: Cockpit Voice Recorder
DC	: Direct Current
ECAM	: Electronic Centralized Aircraft Monitoring
EVAC CMD	: Evacuation Command
FAA	: Federal Aviation Administration
FAR	: Federal Aviation Regulations
FDR	: Flight Data Recorder
FMS	: Flight Management System
GCU	: Generator Control Unit
GS	: Glide Slope
ICAO	: International Civil Aviation Organization
ILS	: Instrument Landing System
IP	: Ice Protection
LOC	: Localizer
LP	: Left Pilot
PF	: Pilot Flying
PIC	: Pilot In Command
PM	: Pilot Monitoring
RNAV	: Area Navigation
RP	: Right Pilot
SRT	: Special Rescue Team
TAPS	: Trajectorized Airport traffic data Processing System
TCAS	: Traffic alert Collision Avoidance System
Aircraft A	: Bombardier DHC-8-315, Registration number JA722A, the Japan Coast Guard
Aircraft B	: Airbus A350-941, Registration number JA13XJ, Japan Airlines Co., Ltd.
Runway A	: HANEDA Airport Runway 16R/34L
Runway B	: HANEDA Airport Runway 04/22
Runway C	: HANEDA Airport Runway 16L/34R
Runway D	: HANEDA Airport Runway 05/23
Tower East	: The air traffic controller in charge of the Tower Control Position East at Airport Traffic Control Tower of Haneda Airport when the accident occurred.

Ground East: The air traffic controller in charge of the Ground Control Position East at Airport Traffic Control Tower of Haneda Airport when the accident occurred.

TAPS : An air traffic control processing system at the airport. Air traffic controllers use this system to control aircraft taking off and landing at airports, it obtains aircraft position and flight plan information from radar, etc. and processes information on departing and landing aircraft, then displays them on the control consoles.

PF : A term used to distinguish pilots from their roles in a two-person aircraft the pilot who primarily flies the aircraft.

PM : A term used to distinguish between pilots in a two-man aircraft based on the division of roles. The pilot is primarily responsible for monitoring the aircraft's flight status, cross-checking the operation of the PF, and performing duties other than flying.

Haneda AS : Japan Coast Guard 3rd Regional Coast Guard Headquarters Haneda Air Station

AC : Alternating current. Electric current whose magnitude and direction change periodically over time.

DC : Direct current. Electric current whose direction does not change with time.

BUS : A conductor rod that distributes and supplies power to each load within a switchboard. Also called a bus. By providing several buses in an aircraft power supply, it is possible to group and manage loads according to purpose, such as for emergencies, important parts, groundwork, etc.

ECAM : An operational status monitoring system for Airbus aircraft. It displays, monitors and issues warnings on engine and system status in various operational situations and supports the flight crew's operations and decisions. It is displayed on a display in the cockpit.

EVAC CMD : Evacuation instruction device. When activated, the "EVAC" light and alarm sound will sound on the panels near all emergency doors, informing nearby crew members that an emergency evacuation has been decided.

1.PROCESS AND PROGRESS OF THE INVESTIGATION

1.1 Outline of the Aircraft Accident

On Tuesday, January 2, 2024, a Bombardier DHC-8-315*1, JA722A (hereinafter referred to as “Aircraft A”), operated by the Japan Coast Guard on Runway 34R at Tokyo International Airport (hereinafter referred to as “Runway C”) and an Airbus A350-941, JA13XJ (hereinafter referred to as “Aircraft B”), operated by Japan Airlines Co., Ltd., which landed on Runway C, collided on Runway C.

There were six persons on board Aircraft A, consisting of the pilot in command (hereinafter referred to as “PIC A”) and five other flight crew members. Aircraft A burst into flames at the same time as it collided with Aircraft B. The PIC A sustained a serious injury and five other crew members sustained fatal injuries. Aircraft A was destroyed by fire.

There was a total of 379 people on board Aircraft B, consisting of the Pilot in Command (hereinafter referred to as “PIC B”)), eleven other crew members and 367 passengers. A fire broke out under the fuselage of Aircraft B at the same time as the collision with Aircraft A, and then Aircraft B continued to taxi, went off the runway and came to a stop in a grassy area near the threshold of the runway. All crew and passengers evacuated from Aircraft B after it came to a stop, but one passenger sustained a serious injury, four passengers suffered minor injuries and twelve passengers were examined by a doctor for feeling unwell. Aircraft B was destroyed by fire.

1.2 Outline of the Accident Investigation

1.2.1 Investigation Organization

On January 2, 2024, the Japan Transport Safety Board (JTSB), upon receiving information about the occurrence of the accident, designated an investigator-in-charge and five other investigators to investigate this accident.

Three investigators were additionally designated on January 5, 2024, and one investigator on January 10, 2024.

In addition, the JTSB changed the investigator-in-charge to the Investigator-General for Aircraft Accident on January 18, 2024.

As a result of personnel transfers, the appointment of two investigators was cancelled on April 1, 2024, and the Investigator-in-Charge was replaced, and an additional investigator appointed on July 1, 2024.

1.2.2 Representatives from Relevant State

An accredited representative and advisors of Canada, as the State of Design and Manufacture of Aircraft A, an accredited representative and advisors of the French Republic, as the State of Design and Manufacture of Aircraft B, an accredited representative and advisors of the United Kingdom, as the State of Manufacture of the engine of Aircraft B, and an accredited representative of the Federal Republic of Germany, as the State of Design of the engine of Aircraft B, as well as an accredited representative and an advisor of the United States of

*1 At the time of the aircraft's manufacture, Bombardier was the type certificate holder for the aircraft, which is now held by de Havilland Canada.

America, as the State of Design and Manufacture of the flight recorders and cockpit voice recorders of Aircraft A and Aircraft B, participated in the investigation.

1.2.3 Implementation of Investigation

January 2 through 3, 2024 On-site investigation

Since then, the following investigation was conducted: examination of the recovered aircraft wreckage, interviews with relevant parties, analysis of the Flight Data Recorder and Cockpit Voice Recorder data, and inspection of relevant parties' facilities.

In addition, the information was collected from passengers on board Aircraft B and from witnesses to the accident.

Taking photographs during an emergency evacuation can potentially hinder an evacuation, but the photographs provided contain important information that would have been difficult to obtain by other means in the investigation of this accident. Therefore, we have decided to include some of them in the interim report. During an emergency evacuation, it is important to follow the instructions of the cabin crew.

2.FACTS

2.1 History of the Flight, etc.

2.1.1 Circumstances Leading up to the Flight of Aircraft A

According to the statements of PIC A, Japan Coast Guard (hereinafter referred to as "JCG") Third Regional Coast Guard Headquarters (hereinafter referred to as "3rd Reg. CG HQ") Operation Center 2nd Operations Officer, (hereinafter referred to as "OC2O A"), Third Regional Coast Guard Headquarters Haneda Air Station (hereinafter referred to as "Haneda AS") Specialist Officer (hereinafter referred to as "Specialist A") and Haneda Air Station Engineer Division mechanics who are qualified to Maintenance Officer the same type of aircraft. towing Aircraft A (hereinafter referred to as "Maintenance A"), records of FDR of Aircraft A, the course of events leading to Aircraft A's movement was as follows:

At around 16:10 on Monday, January 1, 2024, a major earthquake occurred on the Noto Peninsula in Ishikawa Prefecture, and at 16:11 on the same day, JCG established JCG Headquarters HQ TF (hereinafter referred to as the "HQ TF"). for the 2024 Noto Peninsula Earthquake. On the same day, under the command of the Headquarters, Aircraft A departed from Haneda Airport at around 17:43, with different crew member from those than on the following day, and flew along the coast of Toyama Prefecture, Sado Island and Niigata Prefecture to assess the damage caused by the earthquake, returning to Haneda Airport where the Haneda AS is located at around 21:40. At around 23:00, it departed for Komatsu Airport with JCG Special Rescue Station Special Rescue Team(hereinafter referred to as the "SRT") personnel and after dropping off SRT personnel at Komatsu Airport, it returned to Haneda Airport at around 02:30 on Tuesday, January 2.

On Tuesday, January 2, before noon, the officer in charge of HQ TF approached OC2O A about airlifting earthquake relief supplies stored at each Headquarters to 9th Regional Coast Guard Headquarters Niigata Air Station (hereinafter referred to as "Niigata AS"). OC2O A informed Specialist A that Administration Division of 3rd Reg. CG HQ was planned to take the lead in transporting the earthquake relief supplies currently stored in 3rd Reg. CG HQ building to Haneda AS. 3rd Reg. CG HQ also considered that, from the standpoint of transport weight, the Aircraft A, which could carry 794 kg, was more suitable for airlift than the Gulfstream Aerospace type G-V (hereinafter referred to as "G-V"), which can carry 520 kg. A, through OC2O A.

At Haneda AS, flight crew members were assigned to the G-V standby for immediate response that day, but were not assigned to the Aircraft A for immediate response standby. PIC A was on duty as the flight crew member assigned to the G-V's standby for immediate response on the day of the accident. The first officer (hereinafter referred to as "FO A", who was on their day off on the day of the accident, received a change of duty after the earthquake and was assigned to the G-V standby flight crew member, as was PIC A. PIC A was qualified as a captain of a Bombardier DHC-8-315 at JCG, and FO A was qualified as a first officer of Bombardier DHC-8-315 aircraft at Haneda AS.

Specialist A asked PIC A and FO A if it would be possible to transport disaster relief supplies by Aircraft A. PIC A replied that there would be no problem with changing the aircraft as long as the other flight crew members on board could handle it. As Onboard Aviation Maintenance Officer (hereinafter referred to as "OBD Maintenance A"), Onboard Aviation Communications Officer (hereinafter referred to as “OBD Comm A”), Onboard Search RADAR Officer (hereinafter referred to as “OBD RADAR A”), and Onboard Airperson (hereinafter referred to as “OBD Airperson A”) were able to handle the aircraft change, PIC A and FO A decided to transport the supplies by changing the aircraft from G-V to Aircraft A. Specialist A informed OC2O A that Aircraft A was available.

At 14:55, HQ TF issued a formal order to Haneda AS through 3rd Reg. CG HQ to transport disaster relief supplies.

Meanwhile, Haneda AS was also scheduled to receive orders to return to Haneda Airport the SRT personnel who had been dispatched to Komatsu Airport the day before to assist in the disaster relief efforts. OC2O A, Specialist A, and PIC A are flight routes from Haneda Airport to Niigata Airport where Niigata base is located, Niigata Airport to Komatsu Airport, Komatsu Airport to Niigata Airport, and Niigata Airport to Haneda Airport in the case of orders to dispatch SRT personnel to Niigata Airport, On the other hand, in the case of an order to return SRT personnel to Haneda Airport, the flight route would be from Haneda Airport to Niigata Airport, Niigata Airport to Komatsu Airport, and Komatsu Airport to Haneda Airport. However, in the former case, the flight plan could not be finalized immediately because it would be after 21:30, Niigata Airport's operation time. Although it was possible to extend the operation time at Niigata Airport if adjustments were made, they felt that it would be unfair to the air traffic controllers at Niigata Airport to make such adjustments at a stage when the orders had not been finalized amid the confusion caused by the earthquake, when the orders had not yet been finalized, In the end, they decided to create a flight plan with a flight path that would return the SRT team members to Haneda Airport. The flight plan was prepared with a flight path that would return the SRT personnel to Haneda Airport.

At around 15:55, the earthquake relief supplies arrived at Haneda AS from the 3rd Reg. CG HQ building later than scheduled and Specialist A expected it to take about an hour to load the supplies, although some items could not be loaded, with the cooperation of Haneda Air Base staff and SRT personnel, loading was completed in about 25 minutes. PIC A thought that it would take time to unload the earthquake relief supplies at Niigata Airport due to the large volume of the supplies on board. PIC A also wanted to hurry as much as possible, taking into consideration the method of returning home for the flight crew members aboard Aircraft A after returning to Haneda Airport.

After the loading of the relief supplies was completed, PIC A checked the status of the tied-up relief supplies and boarded Aircraft A with 5 other flight crew members. Aircraft A moved to spot N957 (see Figure 1) by towing with Maintenance A at around 16:32.

During towing to spot N957, when OBD Maintenance A started the auxiliary power unit (APU) and connected the APU generator (hereinafter referred to as “APU GEN”) to the power system of Aircraft A. the APU stopped. OBD Maintenance A informed the Haneda AS Communications Office (hereinafter referred to as “Haneda AS Comm Office”) of the malfunction of the APU GEN and requested them to contact Niigata AS and the Air Self-Defense Force Komatsu Air Base, from who OBD Maintenance A planned to request assistance at Komatsu Airport, to see if a power vehicle could be borrowed as a power vehicle would be needed to restart the engine after stopping it at the destination airport. At about 16:43, Aircraft A was towed at spot N957. OBD Maintenance A started the APU again, but when the APU GEN was connected, it stopped again; OBD Maintenance A and Maintenance A determined that replacing the generator control unit (hereinafter referred to as "GCU") of the APU would fix the problem, Maintenance A returned to the hangar to pick up the parts. Maintenance A returned to the hanger and was asked by Specialist A about the standard of the power supply vehicle, which Maintenance A answered, and then returned to Spot N957 with the parts. Just as OBD Maintenance A and Maintenance A were reconsidering whether it was a good idea to suspect a GCU failure when OBD Maintenance A and Maintenance A had not been able to sufficiently troubleshoot the problem, a communication came in from Haneda AS Comm Office that a power vehicle was available to borrow at Niigata AS. OBD Maintenance A proposed to PIC A that engine starting at Niigata Airport be done using a power vehicle instead of an APU, and PIC A agreed.

Although the flight from Haneda Airport to Niigata Airport for the transport of earthquake relief supplies was confirmed, the flight after Niigata Airport was undetermined at the time of departure from Haneda Airport because the availability of power supply vehicles for hire at Komatsu Airport was not known. PIC A advised Specialist A coordinate with HQ TF and 3rd Reg. CG HQ for flights to Niigata Airport or beyond while Aircraft A was en-route to Niigata Airport. PIC A planned to return to Haneda Airport after arriving at Niigata Airport if a power supply vehicle could not be borrowed at Komatsu Airport. Due to the time required to deal with process the APU GEN malfunction, the 2nd Aviation Officer of Haneda AS Flight Division (hereinafter referred to as "2nd Aviation A"), who was on duty to provide operational support, coordinated with an air traffic services flight information officer of the Aeronautical Information Officer (hereinafter referred to as "Information Officer"), and changed the departure slot from 16:45 to 17:25 from Haneda Airport.

2.1.2 History of the Collision of Aircraft A and Aircraft B

2.1.2.1 Aircraft A

According to the statements of PIC A, Flight Division at 2nd Aviation Officer (hereinafter referred to as "2nd Aviation B") was on standby as a flight crew member for rotary wing aircraft, and OC2O A as well as Aircraft A's FDR and CVR records, and ATC communication records (see Appendix 1 1 for details of records), the history of the flight up to the time of the accident is summarized below.

Aircraft A started taxiing from Haneda Airport at Spot N957 at around 17:32.

The flight plan of Aircraft was outlined as follows:

Flight rules: Instrument flight rules (IFR),
Departure aerodrome: Haneda Airport, Off-block time: 17:25, Cruising speed: 230 kt,
Cruising altitude: 12,000,
Route: ROVER (waypoint*2) - AKAGI (waypoint) - Y372 (RNAV*3 route) - KALON (waypoint) - Y37 (RNAV route) - GOSEN (waypoint),
Destination aerodrome: Niigata Airport,

*2 "Waypoint" means a fix used to establish an aircraft's flight path or instrument approach by means of area navigation (RNAV).

*3 "RNAV (Area Navigation) " means navigation by radio facilities, self-contain navigation equipment or satellite navigation equipment, or a combination thereof, using a method of flying an arbitrary route.

Total estimated elapsed time: 1 hour and 10 minutes,

Fuel loaded expressed in endurance: 6 hours and 30 minutes,

Number of passengers: 6.

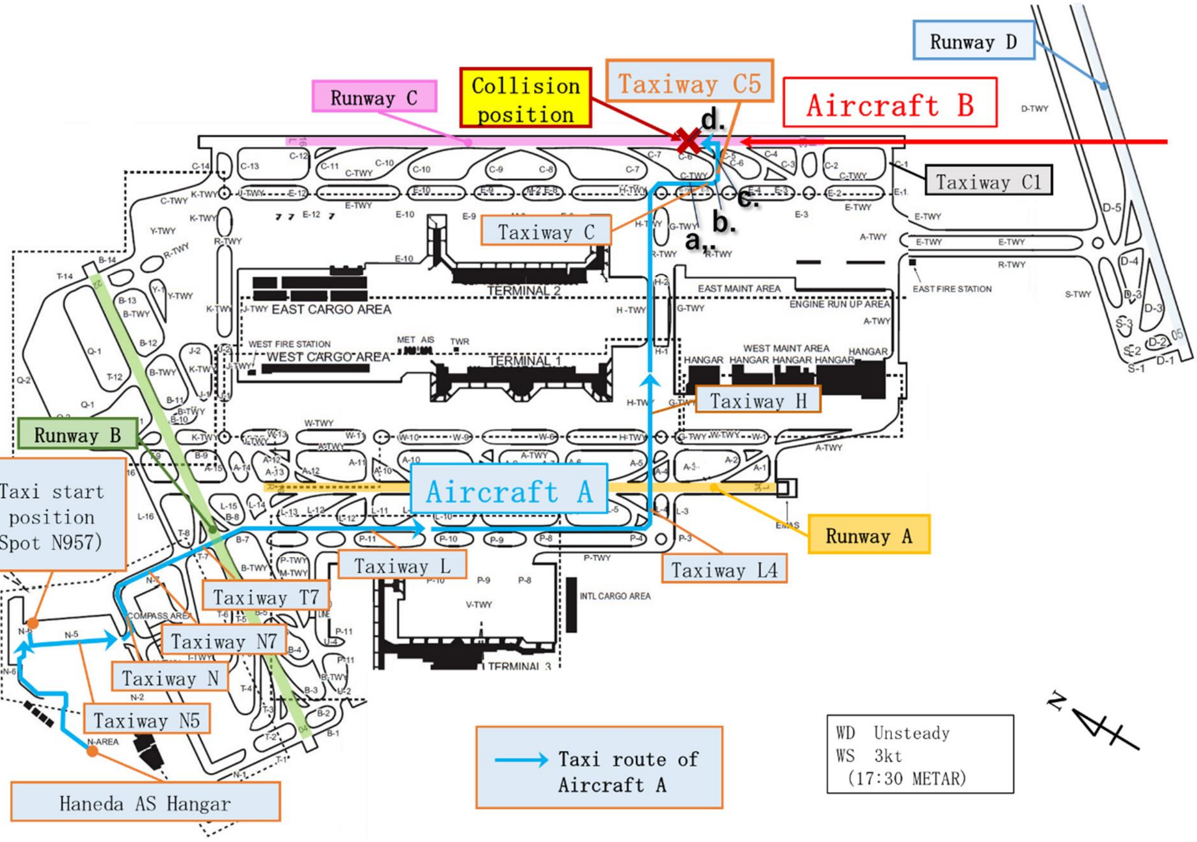


Figure. 1 Taxi Route of Aircraft A

Aircraft A had six passengers on board, consisting of PIC A, FO A, OBD Maintenance A, OBD Comm A, OBD RADAR A and OBD Airperson A. In the cockpit, the PIC A sat in the left pilot's seat as PF*4 FO A sat in the right pilot's seat as PM*4, and OBD Maintenance A sat in the observer's seat in the rear center.

(1) Aircraft A was taxing northeast on Taxiway H when communications were transferred from the air traffic controller at the tower control position west of Tokyo Airport Traffic Control Tower (hereinafter referred to as "Tower West") to the air traffic controller at the ground control position east of Tokyo Airport Traffic Control Tower (hereinafter referred to as "Ground East"). At 17:44:13, Aircraft A was instructed to route from Ground East to taxi to holding point*5,via Taxiway C. At this time, PIC A was aware that there were two or three preceding to the right of Aircraft A and one following aircraft to the left of Aircraft A on Taxiway C. Aircraft A turned right to enter Taxiway C from Taxiway H and its communication was transferred from Ground East to the air traffic controller at the tower control position east of Tokyo Airport Traffic Control Tower (hereinafter referred to as "Tower East"). At this point, PIC A thought that Aircraft A would take off after the preceding aircraft. At 17:45:14, Tower East instructed Aircraft A to taxi to holding point on Taxiway C5 and reported "Number one, taxi to holding point C5" , intending to report that Aircraft A was first in the departure order. Aircraft A read back the instructions from Tower East and continued to taxi to Taxiway C5 (see Figures 1 a. and 2-1 a.).

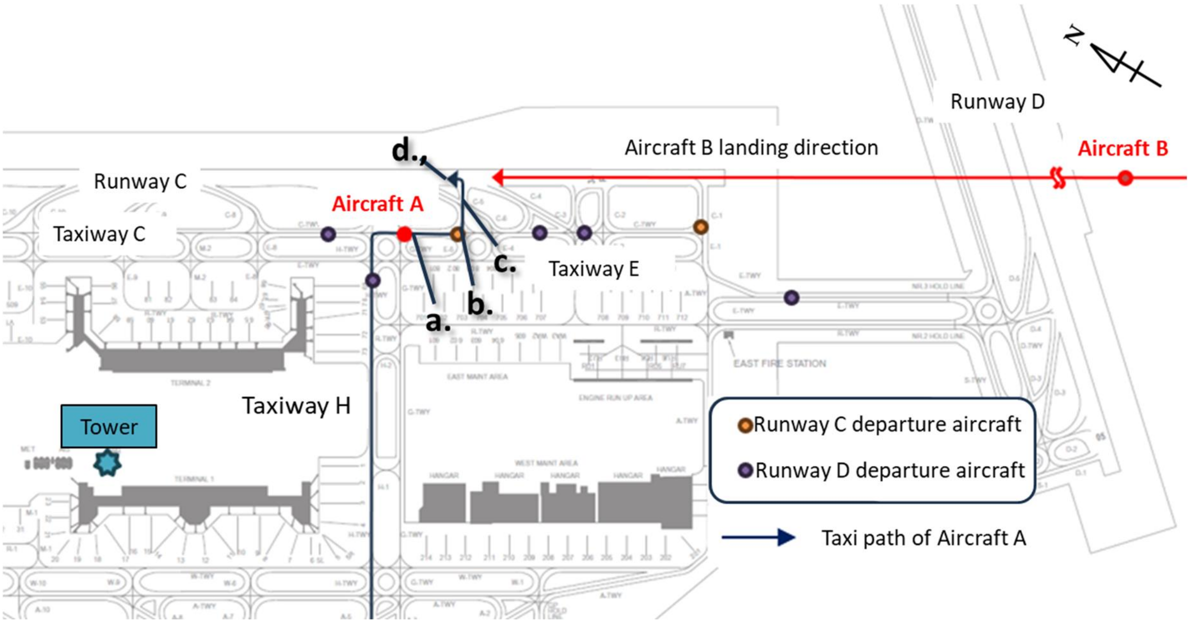


Figure 2-1 Situation when the Communication of Aircraft A was Transferred to Tower East

*4 "PF" and "PM" are terms used to identify pilots by their roles when an aircraft is operated by two pilots. The PF is an abbreviation of Pilot Flying and is mainly responsible for maneuvering the aircraft. The PM is an abbreviation of Pilot Monitoring and monitors flight status, cross-checks operations of PF and undertakes tasks other than maneuvering the aircraft.

*5 "Holding point" means a place where an aircraft or vehicle stops and waits in front of the runway and is located on the taxiway connecting to the runway.

Note that PIC A was instructed by Tower East at this time being told "Runway 34R, line up and wait, you are Number one (Enter Runway 34R and wait. Your takeoff sequence is Number one)". PIC A remembered being told.

As to the reason why PIC A understood PIC A was instructed to taxi to the holding point on Taxiway C5 while other aircraft were heading to Taxiway C1. PIC A thought that this was because the purpose of their flight was to airlift earthquake relief supplies and PIC A had informed the Flight Information Officer about this when submitting the flight plan, and their purpose had been communicated conveyed to the air traffic controllers to the air traffic controllers, who therefore gave priority to take-off of Aircraft A. PIC A confirmed with FO A that the remaining runway distance available for take-off when entering Runway 34R from Taxiway C5 was sufficient for the required take off distance for Aircraft A

PIC A understood that they had received clearance from Tower East to enter Runway 34R from Taxiway C5 and instructed FO A to begin the pre-take off checklist (hereinafter referred to as "Before Take off Checklist") to be conducted after receiving clearance to enter the runway, which FO A did. Aircraft A entered Taxiway C5 at about 17:45:40 (see Figure 1 b. and Figure 2-1 b.). At 17:45:41, FO A turned the anti-collision lights to white according to Before Takeoff Checklist.

After confirming the taxiing of Aircraft A, Specialist A coordinated with 3rd Reg. CG HQ regarding flights after Niigata Airport or beyond. After being informed by the 3rd Reg. CG HQ that it was not possible to borrow a power supply vehicle at Komatsu Airport, Specialist A and 2nd Aviation A, who was qualified to fly Bombardier DHC-8-315, thought that they could pick up SRT personnel and equipment without a power supply vehicle if the right engine of Aircraft A was kept running. Specialist A ordered Correspondent A of Haneda AS Comm Office Communications Officer (hereinafter referred to as "Comm A") to communicate it to Aircraft A to confirm PIC A's decision on this matter.

At 17:46:13, Aircraft A passed the runway holding position marking. on Taxiway C5 (see Figures 1 c. and 2-1 c,). At this time, PIC A, together with FO A, read back "Line up and wait," checked left and right before entering the runway, then entered the runway and stopped.

At 17:46:26, a radio communication was received from Comm A to Aircraft A. The content was to confirm PIC A's decision on whether it would be possible to pick up the SRT personnel and equipment by leaving the right engine running and securing the power supply without using a power supply vehicle, as it was informed that no power supply vehicle was available for to borrow at Komatsu Airport. PIC A was simultaneously listening on the Haneda AS Comm Office frequency and the tower control frequency. OBD Comm A attempted to ask PIC A for a response to the communication from Comm A, but PIC A and FO A replied to OBD Comm A that they would respond later. PIC A expected that 3rd Reg. CG HQ would instruct them to do so at Komatsu Airport. According to PIC A's statement PIC A remembered having received the following clearance a "Runway 34R, cleared for takeoff" from Tower East at a time partially overlapped with this radio exchange.

At 17:46:46, Aircraft A lined up to the centerline of Runway 34R in take- off direction (northwest) (approximately 560 m from the southeast end of Runway C) in takeoff direction (northwest), and at 17:47:27, collided with Aircraft B, which landed on Runway 34R (Figure 1 d. and Figure 2-1 d.) (See Figure 1 d. and Figure 2-1 d.).

(2) PIC A thought the engine had exploded, and after staying down for a few seconds, PIC A tried to check with OBD maintenance A in the observer's seat, but PIC A could not see OBD

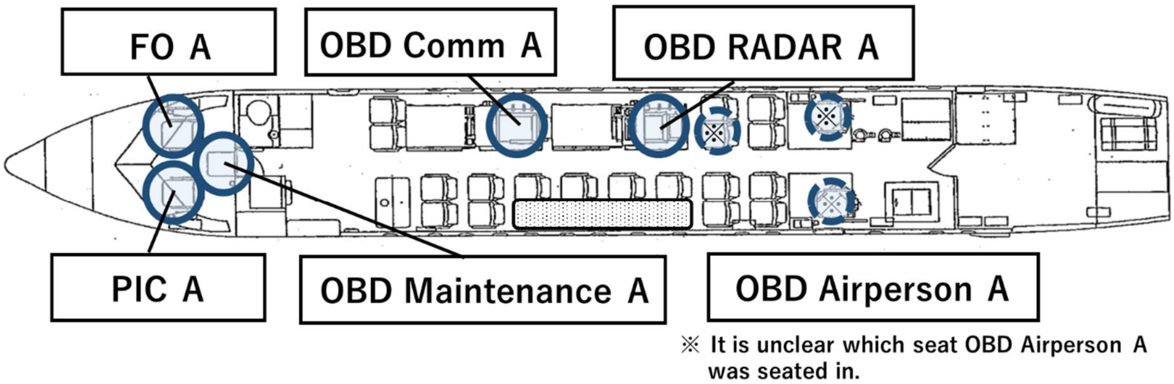


Figure 2-2 Cabin Layout Diagram

maintenance A. FO A also did not know where FO A was. Realizing that the cabin was on fire, PIC A unbuckled his seatbelt while yelling, "Eject!". The emergency escape hatch above the cockpit was detached, and once again, PIC A evacuated through it and to searched for the other five flight crew members, whom PIC A could not find.(see Figure 2-2).

PIC A unable to approach Aircraft A due to the fire, moved to the grassy area east of Runway C and called Haneda AS on PIC A's cell phone: "The aircraft exploded. My body is in ruins from the burns. It was too dark to see other crew members". Upon receiving the call, 2nd Aviation B recognizing from the tone of voice and tone and voice that the call was from PIC A, inquired about the situation and told PIC A to find other crew members to rescue if possible, and to be careful as the aircraft might explode again. PIC A replied, "Okay. 2nd Aviation B, in a voice loud enough for Specialist A in the other room to hear, informed them that PIC A had called to inform them that Aircraft A had exploded and asked them to call all hands because they would be short on manpower. Specialist A was coordinating with 3rd Reg. CG HQ for flights after Niigata Airport or beyond. Upon receiving a call from 2nd Aviation B, they shared the information with Haneda Special Rescue Station and prepared to dispatch SRT personnel to the accident site. As OC2O A called 2nd Aviation B. 2nd Aviation B gave PIC A's phone number. OC2O A contacted PIC A and received a report from PIC A that "the aircraft exploded when the aircraft was cleared to 'Line up and wait' on Runway 34R, 'Cleared for take-off", and increased engine power" and CO2O A shared this report with Haneda AS. After seeing aircraft in flames on the TV broadcast, 2nd Aviation B called PIC A and told PIC A that there should be fire engines and ambulances nearby and that PIC A should ask them to rescue. Maintenance A and 2nd Aviation A drove to the accident site in a Haneda AS vehicle with SRT personnel equipped with burn response emergency equipment and led by a Information Officer's vehicle.

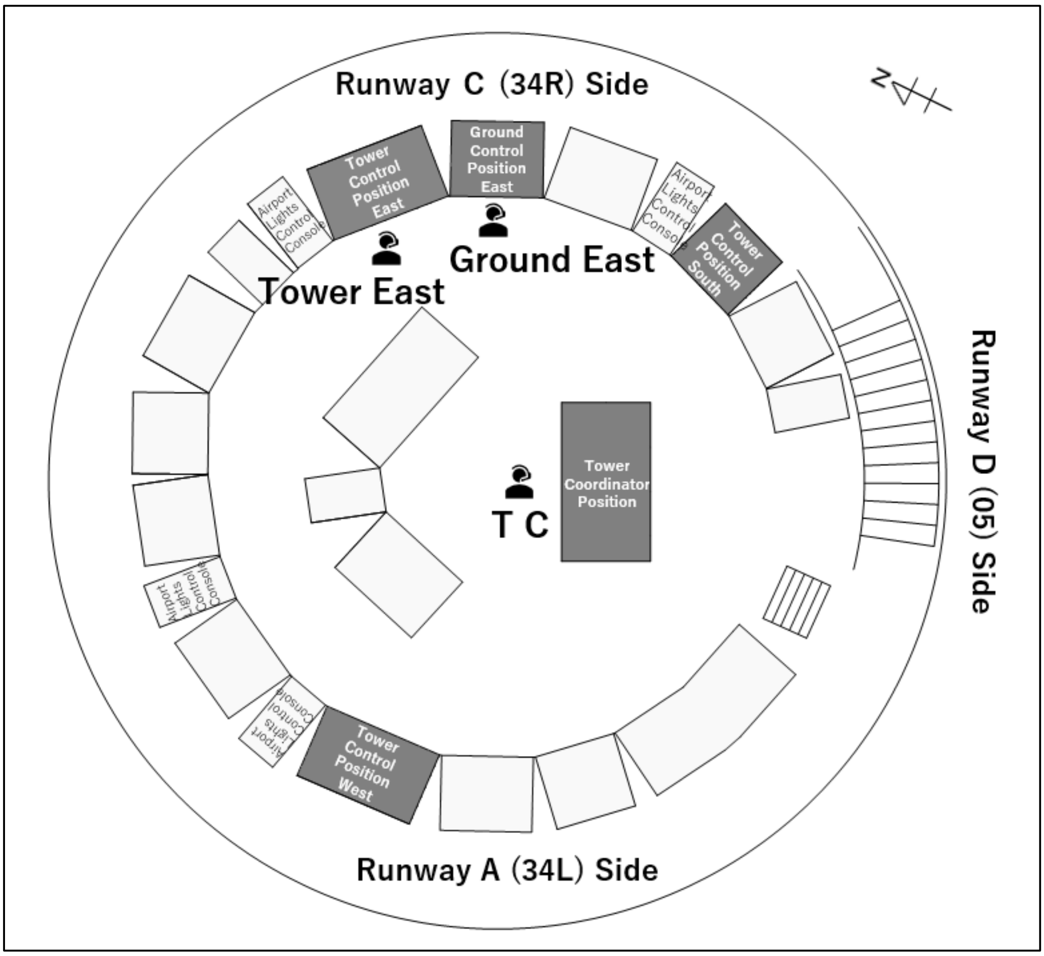
PIC A called out to a Firefighter (hereinafter referred to as ""Airport Firefighter") assigned to the Tokyo Airport Office (hereinafter referred to as "Airport Office") who was engaged in extinguishing a fire that had occurred on Aircraft A. PIC A rested near the fire engine while waiting for rescue and was treated for burns by SRT personnel who arrived at the scene and was transported to a hospital by ambulance.

2.1.2.2 Air Traffic Control Operations at Tokyo Airport Traffic Control Tower

According to the statements of Tower East and Ground East, who were in charge of controlling the aircraft departing from and landing on Runway C, and the air traffic controller at the Tower Coordinator position (hereinafter referred to as "TC"), and the records of ATC communications, the direct phone lines between the control positions, the radar track and Multilateration System*6, the progress of ATC operations up to the time of the accident is summarized as follows.

(1) On that day, the team to which Tower East belonged consisted of 10 air traffic controllers including the deputy-chief air traffic controller in a managerial position and a trainee, who were scheduled to work from 12:00 to 21:15. The team held a briefing at 14:05 and then moved to the Operation Room of Tokyo Airport Traffic Control Tower (hereinafter referred to as "the Operation Room") at around 14:15, took over the duties from the previous team, and started working with the two controllers who were already working in the Operation Room.

Tower East performed duties at the Tower Control Position West from around 15:05, at the Ground Control Position East from around 15:50, at the Tower Control Position South from around 16:35. After a 20-minute break, Tower East resumed duties at the tower control position east from around 17:20 (see Figure 3).



*6 "Multilateration System" refers to a system designed to locate an aircraft's position by receiving signals transmitted from an air traffic control transponder on board an aircraft at multiple receivers installed at an airport.

Figure 3: Operation Room of Tokyo Airport Traffic Control Tower

Tower East noticed that Taxiway C, used by departure aircraft departing from Runway 34R, was also being used by departure aircraft normally heading for Runway 05 (Runway D) via Taxiway E, and that Taxiway C was becoming congested. Tower East did not know why the departure aircraft heading for Runway 05 were using Taxiway C but thought it might be related to an aircraft being towed (hereinafter referred to as the "towed aircraft") and others.

At around 17:42, Tower East noticed Aircraft A crossing Runway 34L (Runway A) and taxing on Taxiway H. Tower East had checked the flight plan in advance and understood that although Aircraft A was a JCG, it was a flight for transporting supplies and did not require priority such as a search and rescue flight. At this point, Tower East had not yet decided the takeoff order for Aircraft A because Taxiway C, which merges with Taxiway H, was congested. At this time, Tower East received confirmation of the departure time of Aircraft A via the override*7 from the air traffic controller in charge of Haneda departure coordination position *8at Tokyo Radar Approach Control Facility*9 (hereinafter referred to as "DF"). Tower East answered that "Ground control is busy (because Taxiway C is congested), so I don't know when Aircraft A will be handed over to me", DF informed Tower East that the aircraft taking off after Aircraft A might be delayed (because Aircraft A's flight speed was slower than other aircraft).

At 17:43:02, Aircraft B, whose communications had been transferred from Tokyo Radar Approach Control Facility, called Tower East. Tower East, who was planning to have another aircraft (hereafter referred to as "Aircraft C") take off other than Aircraft A, which was taxiing on Taxiway C, before Aircraft B would land, instructed Aircraft B to continue its approach to Runway 34R, and also informed the wind was 320°, 7kt(northwesterly wind of 3.6 m/s), and that there was a departure aircraft. Aircraft B read back the instruction of continuing its approach to Runway 34R.

At 17:43:26, Aircraft C, whose communications had been transferred from Ground East, called Tower East. Tower East instructed Aircraft C to taxi to the runway holding position on Taxiway C1. Aircraft C read back that it would stop at the runway holding position on Taxiway C1. Tower East felt that the taxiing speed of Aircraft C was slower than expected due

*7 "Override" refers to one of the interphone functions that allows direct communication between the air traffic controller's control positions, and this refers to a function that enables to interrupt another line and talk on the headset of another line. As it is possible to interrupt a call regardless of the work situation of the other party, the interrupted party is not obliged to respond immediately and the other party responds appropriately, taking into account the workload at their own positions and others.

*8 "Haneda Departure Coordination Position" refers to the control position in Tokyo Radar Approach Control Facility that responsible for coordinating duties of the setting control separations for aircraft taking off from mainly Haneda Airport, while checking the airspace monitoring screen and the screen displaying the airport surface. When a notification is received from Tokyo Airport Traffic Control Tower regarding a go-around of arrival aircraft, Haneda Departure Coordination Position will instruct the flight route, altitude and frequency to be used by the go-around aircraft.

*9 "Tokyo Radar Approach Control Facility " refers to the ATC facility to provide the terminal radar control service and approach control service mainly for departure/arrival aircraft at Haneda Airport and Narita International Airport. Tokyo Airport Office has two air traffic control facilities: Tokyo Airport Traffic Control Tower and Tokyo Radar Approach Control Facility.

to the congestion on Taxiway Cand decided that Aircraft C would take off after Aircraft B had landed.

After that, Tower East considered that the distance between Aircraft B and the following aircraft (hereinafter referred to as "Aircraft D") is approximately 7 nm (approximately 13 km), that the distance between the aircraft would decrease even if Tower East instructed Aircraft D to slow down, that if Aircraft C, which was the departure aircraft on a long-range international flight, took off before Aircraft D landed, wake turbulence could affect Aircraft D's landing. Then Tower East determined that if Aircraft A took off between the landing of Aircraft B and Aircraft D, Aircraft D would be able to land without having to consider the effects of wake turbulence, and that because Aircraft D would land after Aircraft A took off, the takeoff interval between Aircraft A and Aircraft C, the following departure aircraft with a faster flight speed than Aircraft A, could be set efficiently. Having decided that Aircraft A would take off after Aircraft B had landed, Tower East communicated this to DF at 17:44:36. Following this decision, DF instructed Tower East to wait the issue of takeoff clearance for Aircraft C, which was due to depart after Aircraft A had taken off.

At 17:44:56, after confirming that there were no aircraft taking off from Runway 05, which was not available depending on the position of the aircraft approaching Runway 34R, Tower East issued landing a clearance for Runway 34R to Aircraft B, which was approaching a point approximately 5 nm on the final approach course.

At 17:45:10, Aircraft A on Taxiway C, whose communications had transferred from Ground East, called Tower East. Tower East informed Aircraft A that it was Number one to take off and as there were four departure aircraft taxiing ahead of Aircraft A, in order to allow Aircraft A to take off as planed after Aircraft B had landed and before Aircraft D had landed, Tower East instructed Aircraft A to taxi to the runway holding position on Taxiway C5 so that Aircraft A could make an intersection departure from Taxiway C5, which was the closest taxiway to Aircraft A's position. Aircraft A read back to Tower East that it was taxiing to the runway holding position on Taxiway C5 and that it was Number one. Tower East confirmed that there was no error in the readback from Aircraft A and visually confirmed that Aircraft A was taxiing to Taxiway C5.

At 17:45:39, the communication of the departure aircraft, taxiing ahead of Aircraft A on Taxiway C (hereinafter referred to as "Aircraft E") were transferred from Ground East to Tower East, and called Tower East. Tower East advised Aircraft E that it was Number three (in the takeoff order) and instructed it to taxi to the runway holding position on Taxiway C1.

At 17:45:55, Aircraft D, whose communications had been transferred from Tokyo Radar Approach Control Facility, called Tower East. Tower East instructed Aircraft D to continue its approach to Runway 34R, informing it that it was second (in order to land), that the wind was 320° and 8 kt (north-westerly wind of approximately 4.1 m/s), and that there was a departure aircraft, and instructed it to slow down to 160 kt (approximately 296km/h).

Tower East confirmed that all of the five aircraft for which it was responsible had been handled as expected, as follows: Aircraft A had entered Taxiway C5, landing clearance had been issued to Aircraft B, Aircraft C was stopped on Taxiway C1, Aircraft D had been instructed to give Aircraft A sufficient clearance for takeoff, and Aircraft E was behind the two departure aircraft heading for Runway 05 (see Figure 4).

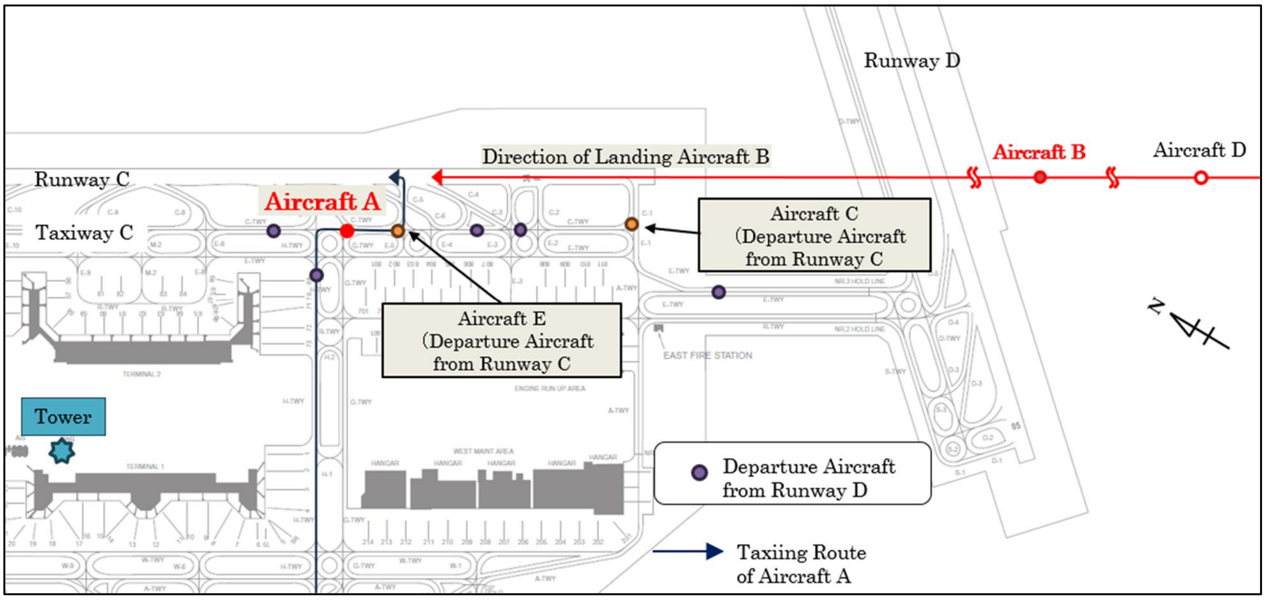


Figure 4: Traffic Conditions at around 17:45

At 17:46:11, the Air Traffic Controller in charge of Haneda Approach Coordination Position South[*10] (hereinafter referred to as "AFS") at Tokyo Radar Approach Control Facility requested Tower East by override to reduce the separation between arrival aircraft scheduled to land in approximately 15 minutes. Tower East checked the status of departure aircraft on the TAPS screen (Airport Surface Monitoring Screen), which shows the status of aircraft on the ground (see Figure 23) and found that there were many departure aircraft scheduled to take off in about 15 minutes, so Tower East declined the request from AFS. As coordination with Tokyo Radar Approach Control Facility regarding the landing intervals of arrival aircraft is normally the responsibility of TC, Tower East communicated the results to the TC (see Figure 3) who was standing behind Tower East. On the other hand, TC had received the same request from the air traffic controller in charge of Haneda Radar Coordination Position[*11] (hereinafter referred to as "OA") at Tokyo Radar Approach Control Facility, and, like Tower East, had declined.

When Tower East turned its attention to Aircraft B, which was approaching the runway to land, Tower East noticed that behind Aircraft C, which was on Taxiway C1, an aircraft which had been taxiing on Taxiway C toward Runway 05 had stopped. Tower East remembered an incident that had occurred about six months ago[*12], and while considering

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*10 "Haneda Approach Coordination Position South" refers to the air traffic controller's position in Tokyo Radar Approach Control Facility that coordinates with other air traffic control facilities to establish air traffic separations for arrival aircraft at Haneda Airport mainly from the south.

*11 "Haneda Radar Coordination Position" refers to the air traffic controller's position in Tokyo Radar Approach Control Facility that coordinates operations between the individual control positions according to the situation. It also coordinates operations with Tokyo Airport Control Tower, such as landing intervals between arrival aircraft.

*12 On June 10, 2023, at Haneda Airport, the left horizontal stabilizer of an EVA Airways aircraft that was stopped just short of Runway A was contacted by the right wing tip (winglet) of a Thai Airways International aircraft that was passing behind it. The incident was not classified as an aircraft serious incident or an aircraft accident, with no injuries, but Runway A was closed while the aircraft involved were towed to the apron by a vehicle.

instructing Aircraft C to move forward a little, Tower East kept an eye on Ground East, who was in charge of the aircraft that had stopped behind Aircraft C.

At 17:47:12, as Tower East moved toward Ground East, Tower East heard a DF's voice over the hot microphone*13 speaker asking what was happening to Aircraft B. Tower East did not understand the intent of DF's inquiry because Aircraft B appeared to be continuing its approach to the runway for landing without any problems. Tower East continued to watch Aircraft B, thinking that it might make a go-around.

At 17:47:22, in order to allow time for Aircraft A to take off between the landing of Aircraft B and Aircraft D, Tower East instructed Aircraft D to reduce its speed to the minimum approach speed and confirmed the readback from Aircraft D. In order for Aircraft A to take off before Aircraft D landed, Tower East had to give the line up and wait instruction for Aircraft A immediately after Aircraft B passed in front of C5. Therefore, in order not to miss the timing of the instruction to Aircraft A, Tower East followed the movements of Aircraft B as it was approaching the runway to land. Tower East was not aware that Aircraft A was entering the runway.

As Aircraft B passed near Taxiway C5 and Tower East was about to give Aircraft A the instruction to line up and wait on the runway, Tower East saw flames coming from Aircraft B.

At 17:47:29, Tower East was asked again by DF via hot microphone about the status of Aircraft B, but Tower East did not respond. At 17:47:40, the Airport Control Tower reported the fire on Runway C to Airport Security and Disaster Prevention Division of Airport Office, the Flight Information Officer, and Tokyo Radar Approach Control Facility via crash-phone.

(2) At 17:48:10, after instructing Aircraft D to go around, Tower East handed over duties to the relief air traffic controller. The air traffic controller coordinated with DF for the flight route, altitude, and frequency to be transferred for the go-around Aircraft D, and at 17:49:15, transferred communications for Aircraft D to the Tokyo Radar Approach Control Facility.

In order to provide a route for vehicles responding to the accident, Ground East instructed all aircraft under its responsibility to stop at their current positions. Ground East then instructed the aircraft to taxi to their parking area to ensure the safety of the passengers who had evacuated from Aircraft B and not to interfere with the vehicles and personnel responding to the accident.

On the other hand, Tokyo Radar Approach Control Facility handled the aircraft that made a go-around due to the accident and the aircraft under its control, and changed the destination airports for these aircraft, diverting them to Narita International, Chubu International, and Kansai International, and other airports.

2.1.2.3 Aircraft B

According to the statements of the crew of Aircraft B, the FDR and CVR records of Aircraft B, air traffic control communication records (see Appendix 1 for details of the records), video footage provided by passengers, and materials provided by Japan Airlines Co., Ltd. (hereinafter

*13 "Hot microphone" refers to an intercom function that allows direct communication between control positions and refers to the ability to make one-way reports to the call recipient. Since reports can be made unilaterally regardless of the work situation at the call recipient's position, the call recipient is not obligated to respond immediately, and will respond appropriately taking into account the amount of work etc.

referred to as "the Company"), which operated Aircraft B, the course of Aircraft B's flight was roughly as follows:

(1) Status of Passengers and Crew

Aircraft B took off from New Chitose Airport at 16:27 as scheduled flight 516 of the Company. There were 379*14 people on board, including PIC B, two flight crew members, nine cabin crewmembers, and 367 passengers (including 42 children*15 and 8 infants*16) (see Figure 5).

In the right seat was a pilot undergoing training to obtain the company's A350 co-pilot qualification (hereinafter referred to as the "Training Crew"), who was in charge of flying as a PF. PIC B was in the left seat, and while performing PM duties, he was also supervising the Training Crew in the right seat. In addition, a qualified A350 co-pilot (hereinafter referred to as the "Safety Pilot"), who is required by the company's regulations to be on board when a Training Crew is on board, was sitting in the observer seat in the cockpit.

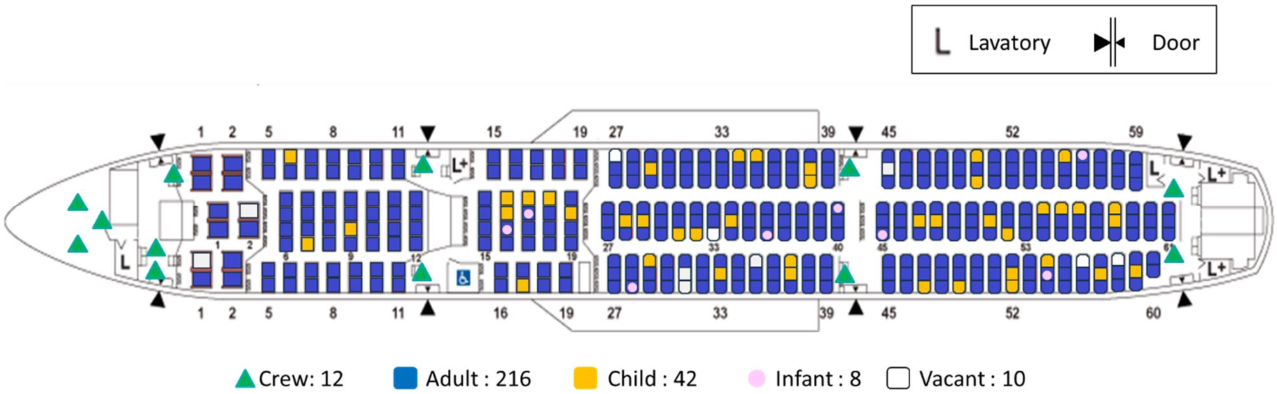

Figure 5　Seating Situation of Passengers on Aircraft B
(Passengers status is as of the time of booking)
(Created based on materials provided by the Company)

(2) Situation after Communication with Tower East

Aircraft B's flight after takeoff from New Chitose Airport was smooth, and it had sight of Runway 34R for landing before communication with the Tower East began. At 17:43:02, Aircraft B began communication with the Tower East and was instructed to continue its approach to Runway 34R, and at 17:44:56, it was cleared to land on Runway 34R.

After receiving clearance to land, the flight crew of Aircraft B expected the wind to change during the approach, since the wind during the flight was southwesterly, although the wind reported by the Tower East was northwesterly. The flight crew was concerned that the approach speed would change suddenly due to this wind change and continued the approach with the intention of going around if a sudden change in speed occurred.

At around 17:45:40, Training Crew switched from autopilot to manual control at an altitude of 1,140 ft.

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*14 "Adult" in the figure 5 is a person traveling on a paid adult fare. And the ratio of male to female adult passengers was approximately 1:1, and the ratio of male to female passengers in each of the three sections (front, middle, and rear) separated by the doors was also approximately 1:1.

*15 "Child" means a person traveling on a paid child fare.

*16 "Infant" means a child 2 years of age or younger sitting on an accompanying passenger's lap.

At around 17:46:20, after passing an altitude of 1,000 ft, the pilots of Aircraft B confirmed that the wind direction during flight was roughly the same as the ground wind direction and continued the approach to Runway 34R.

At around 17:47:26, the main landing gear of Aircraft B touched down on the runway, and reverse thrust levers was set in position. At almost the same time as the operation, a small aircraft, highlighted by the landing lights of Aircraft B, suddenly appeared in front, and a large impact occurred. Until this time, the flight crew of Aircraft B had not recognized that an aircraft was on the runway. The role of the safety pilot was to monitor communication with air traffic control agencies in addition to the usual duties of a co-pilot, including external monitoring (see 2.18.2.2), and he monitored the communication status with air traffic control agencies and flight parameters during the final approach until the collision. PIC B and the Training Crew also used the Head Up Display (hereinafter referred to as "HUD") during the flight.

When the large impact from the collision occurred, Aircraft B's ground speed was 120kt (222km/h), its pitch angle was 3.5° upward, its heading was 337° (magnetic heading), and its nose landing gear was not on the ground.

After the collision, Training Crew handed over control to PIC B, who applied the brakes but did not feel a corresponding decrease in speed. After the collision, the aircraft's course gradually deviated to the right, so PIC B tried to correct the course using the steering and rudder, but the aircraft did not respond to his commands.

After that, Aircraft B deviated to the east of Runway 34R at approximately 2,118 m from the southeast end of Runway 34R, then traveled through the green area on the east side of the runway and struck the approach angle indicator (PAPI) installed for Runway 16L. The aircraft came to a stop at around 17:48:14, 2,298 m from the southeast end of Runway 34R and 56 m east of the runway center (26 m from the long side end) with a heading of approximately 345° (magnetic) (see Figure 6).

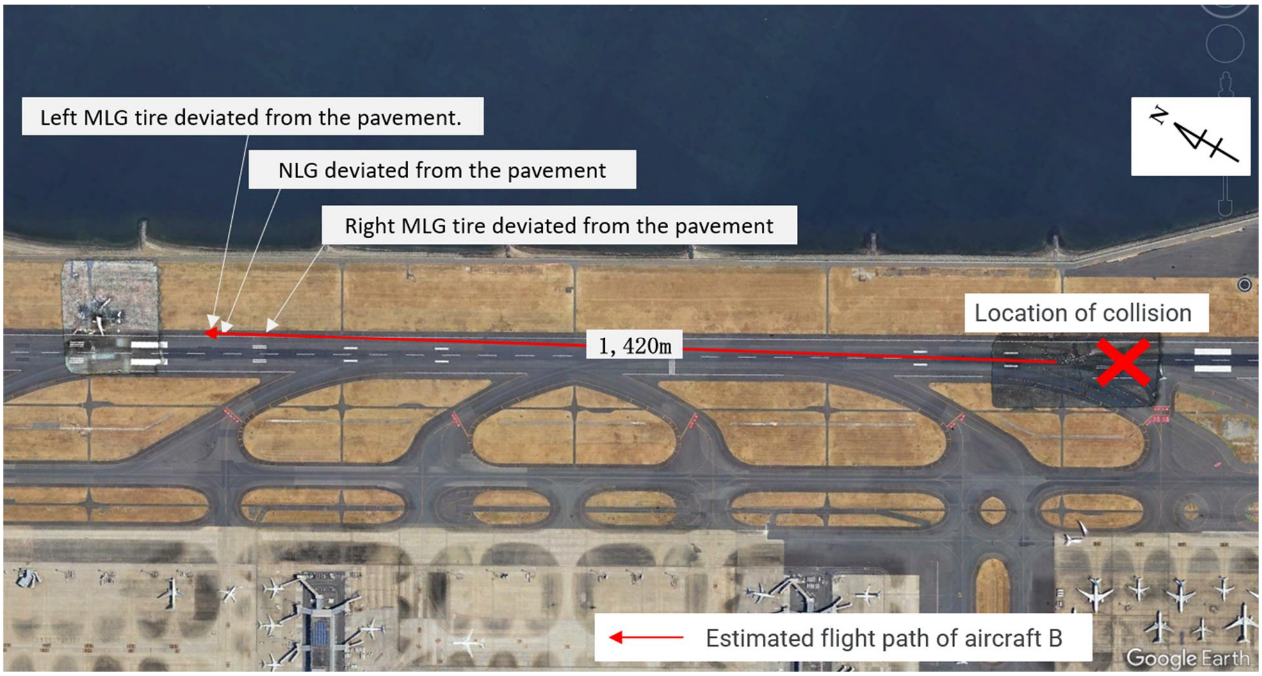


Figure 6　Flight Track of Aircraft B after the Collision

Meanwhile, in the cabin, an abnormal sound was heard immediately after the main landing gear of Aircraft B touched the ground. At the same time, it was felt as if the aircraft was running over something, but there was no sense of significant deceleration. Immediately after the abnormality occurred, some passengers saw fires near the undersides of both wings, and an unusual smell began to emanate from the cabin near the third exit from the front.

From the time of the collision until the aircraft came to a stop, each cabin crewmember tried to talk to the other cabin crewmembers by intercom but was unable to communicate via intercom. After the abnormality occurred, the aircraft began to vibrate, so the cabin crewmembers repeatedly shouted out instructions to passengers to "lower their heads" to have the passengers take a position against impact.

2.1.3 Emergency Evacuation on Aircraft B

After the aircraft came to a stop, PIC B decided to immediately perform an emergency evacuation and initiated the emergency evacuation procedures. While performing this procedure, PIC B received a report of a fire from a flight attendant in the cockpit, but as the Evacuation Command Device (hereinafter referred to as "EVAC CMD") and the in-flight public address system were not operational, PIC B loudly instructed the flight attendant to evacuate. PIC B and the training crew followed the checklist to shut down the left and right engines and to discharge fire extinguishing agent into both engines. As a result of this procedure, the left engine shut down, but the right engine did not shut down. There was no indication in the cockpit instruments regarding the operation status of engines, and the flight crew was unaware of the status of either engine.

During performing the emergency evacuation procedures, the three flight crew members attempted to use the EVAC CMD and the in-flight public address system to communicate emergency evacuation instructions to the crew and passengers in the cabin, but neither system was functioning, and the emergency evacuation instructions could not be communicated simultaneously. After completing the emergency evacuation procedures, the three flight crew members left the cockpit and assisted the passengers in evacuating the aircraft.

In the cabin, white smoke began to rise from the gap between the side wall and under the floor near the third exit from the front, and gradually became thicker along with an irritating smell. After confirming that the aircraft had come to a complete stop, the cabin crew implemented panic control to calm the passengers, while also checking the situation outside the aircraft and attempting to provide emergency report of that information to PIC B. However, they were unable to make a call via the intercom, nor were they able to talk to any of the other crew members via the intercom. The cabin crewmembers in charge of the second exit from the front on the left side (hereinafter referred to as "L2"), the second exit from the front on the right side (hereinafter referred to as "R2"), the third exit from the front on the left side (hereinafter referred to as "L3"), the third exit from the front on the right side (hereinafter referred to as "R3"), and the rearmost exit on the right side (hereinafter referred to as "R4") confirmed fires outside their assigned exits and therefore determined that those doors could not be used for emergency evacuation. In particular, the cabin attendant in charge of R4 saw not only a fire but also sparks flying toward the rear, which was also a reason why R4 was not used for the emergency evacuation.

The chief flight attendant and the left-most forward exit flight attendant (hereafter referred to as "L1"), who noticed that the cockpit door had come loose, went to the cockpit, and reported the situation to the flight crew. The chief flight attendant and the L1 flight attendant, who had received emergency evacuation instructions from PIC B, shouted instructions to the right-most forward exit flight attendant (hereafter referred to as "R1"). Upon receiving this information, the flight attendant in charge of R1 and the chief flight attendant checked the situation outside the aircraft, then at approximately 17:51:30, opened the L1 and R1 doors, deployed the escape slides, and began the emergency evacuation of passengers (see Figure 7).

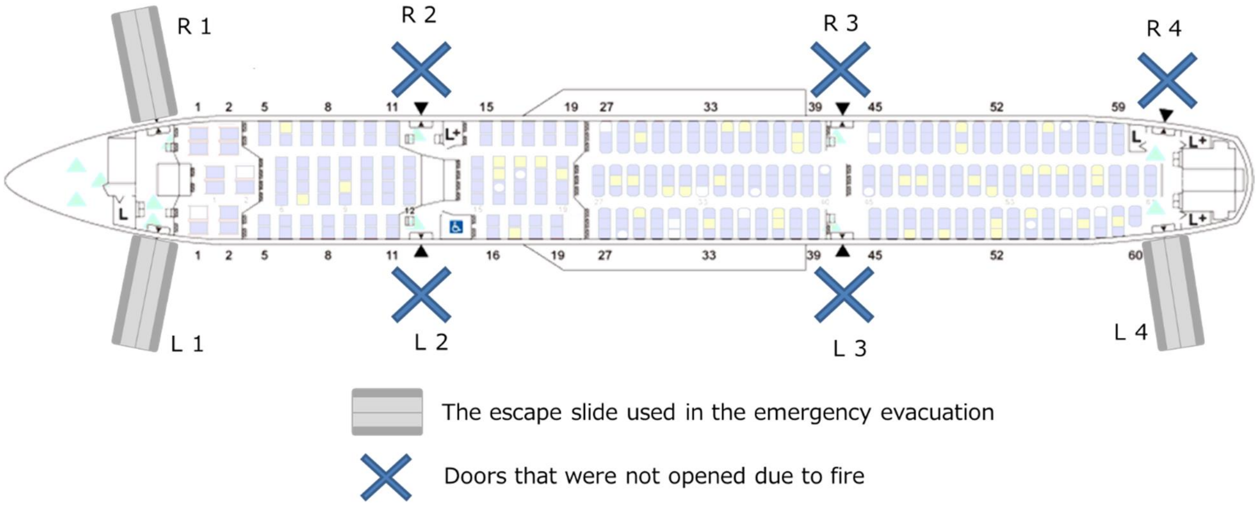


Figure 7 Exits Used for Emergency Evacuation

After the emergency evacuation from L1 and R1 had begun, PIC B and the chief cabin crewmember instructed the passengers to evacuate from the front, while moving towards to rear of the cabin and trying not to impede the evacuation of passengers heading toward L1 and R1.

The L2 and R2 cabin crewmembers noticed that the light was coming from the front of the cabin and that passengers were starting to move forward. They concluded that an emergency evacuation had begun and instructed nearby passengers to move forward to evacuate.

The cabin crewmembers behind the third exit from the front were unable to receive instructions from PIC B to evacuate and continued to care the passengers as the smoke became increasingly thicker. During this time, the cabin intercom was not working, and the cabin crewmembers were unable to communicate with each other. The cabin crewmembers who decided not to use the exits due to the fire could not move away from the doors of their respective exits to prevent passengers from accidentally opening them. Therefore, the cabin crewmembers in charge of the third and fourth exit directly called out to each other to check whether there were any usable escape exits.

The cabin crew member in charge of L3 looked forward from its position, but the smoke had become thick, and visibility was poor, so the person was unable to confirm the situation near the second exit. The person saw a faint flashlight but was unable to determine if it was someone calling the person. PIC B and the chief cabin crewmember, who were in the front, proceeded to the rear of the cabin amid the smoke, as passengers were evacuating from the front, and it was possible for them to move to the rear through the aisle. They instructed the cabin crewmember in charge of L3 to evacuate passengers to the front, and the cabin crewmember instructed the surrounding passengers to evacuate from the front.

Figure 8 shows the smoke situation photographed from the rear seat at L3. With the normal lights turned off and only the emergency lights on, the smoke gradually became thicker.

2 minutes from aircraft stop | 3 minutes 20 seconds | 4 minutes 20 seconds | 5 minutes 20 seconds

Figure 8　Situation of Smoke Coming in the Cabin
(Provided by passenger in the rear area close to L3)

The cabin crewmember in charge of R3 saw surrounding passengers moving toward the front and heard a voice saying "evacuate" (utterance unknown), so the person instructed the surrounding passengers to evacuate from the front.

The cabin crewmember in charge of the left-hand exit at the rearmost of the aircraft (hereinafter referred to as "L4") continued to assess the situation while taking care to passengers. As smoke filled the cabin and the surrounding situation became increasingly dire, she decided that in order to rescue the passengers she had to open her assigned door, even though she could not receive instructions for an emergency evacuation. After looking outside L4 and confirming that there was no source of fire, no fuel leaks, and that there was space to deploy the slides, the person opened L4 at around 17:55 and instructed the surrounding passengers to evacuate.

Most passengers acted calmly and followed the crew's instructions. In addition, some passengers*17 did not receive direct emergency evacuation instructions from the crew, which were given in both Japanese and English. Some of these passengers noticed the movements of passengers around them and followed them to escape, while others followed the instructions of the cabin crew members to stay low near their seats and wait for further instructions from the cabin crew members. The passengers who remained near their seats were found by PIC B, who was searching the cabin for passengers who had not yet escaped, escaped. PIC B confirmed that no passengers or other crew members were left behind in the cabin and evacuated from L4 at 17:58. After the evacuation, each crew member gave the passengers direction and verified them, and PIC B reported to the Company by mobile phone that all the passengers on board Aircraft B had escaped.

*17 The “some passengers” include passengers of foreign nationality.

The number of passengers who evacuated from each exit was approximately 340-350 using L1 and R1, and approximately 20-30 using L4.

After the aircraft stopped, the cabin lighting was on, consisting of emergency lights installed on each door and on the ceiling of the cabin compartment. This allowed the cabin to remain bright enough to see the surroundings. However, as smoke filled the cabin over time, visibility deteriorated, especially in the rear cabin.

Aircraft B was equipped with four megaphones, which were used by some of the crew after the emergency evacuation began. Some crew members stopped using the megaphones because they felt that their voices were difficult to hear due to the noise of the cabin and the engine noise from outside, while others tried to use the megaphones but were unable to make a sound, so they switched to giving instructions by natural voice. Two of the four megaphones that were installed on the aircraft were retrieved after the accident.

Some passengers*17 were interviewed to confirm the circumstances under which the emergency evacuation instructions were given by the crew and the trigger for the evacuation to begin. The results are shown in Figure 9.

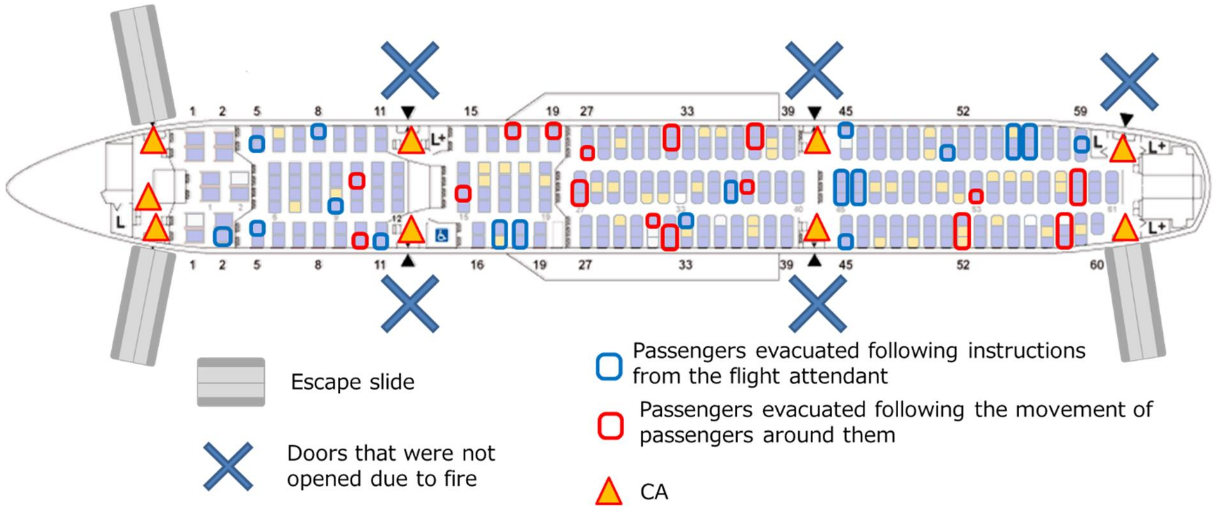


Figure 9 Situation of Awareness for Evacuation Instructions from Crew Members (Interviews with some passengers)

2.1.4 Situations of Inside the Cockpits of Aircraft A and B

The situations of the cockpits of Aircraft A and B before the accidents are as shown in Appendix 1

2.2 Injuries to Persons

2.2.1 Aircraft A

5 people were fatally injured (cause of death: details are being confirmed), 1 person was seriously injured (burns)

2.2.2 Aircraft B

One seriously injured (broken ribs) and four slightly injured. Twelve other passengers complained of feeling unwell and sought medical attention.

2.3 Damage to the Aircraft

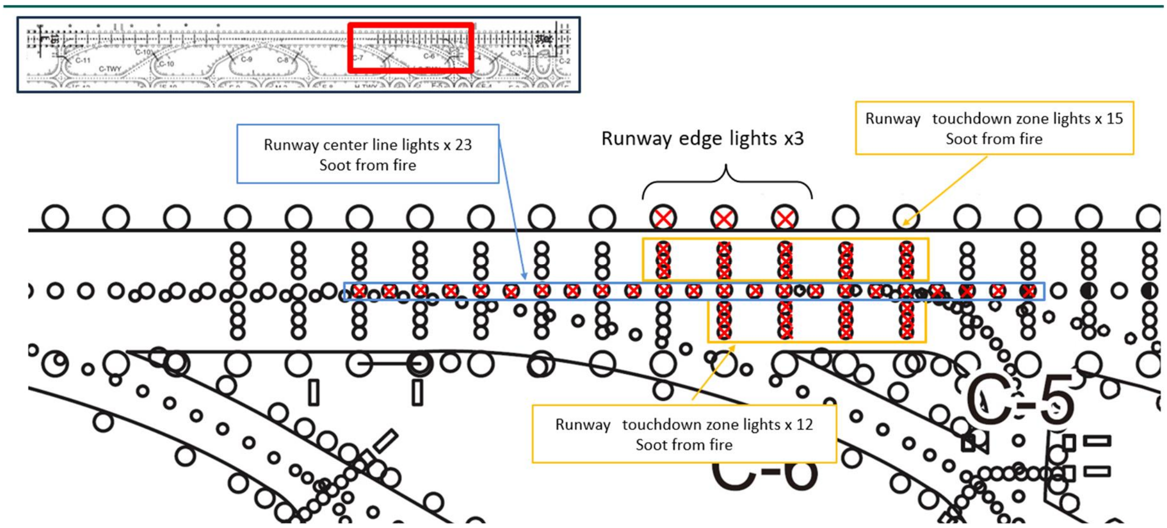
Both Aircraft A and B were heavily damaged due to destruction from the collision and destruction from fire. The condition of the wreckage of both aircraft will be described later in Section 2.13.

2.4 Other Damage

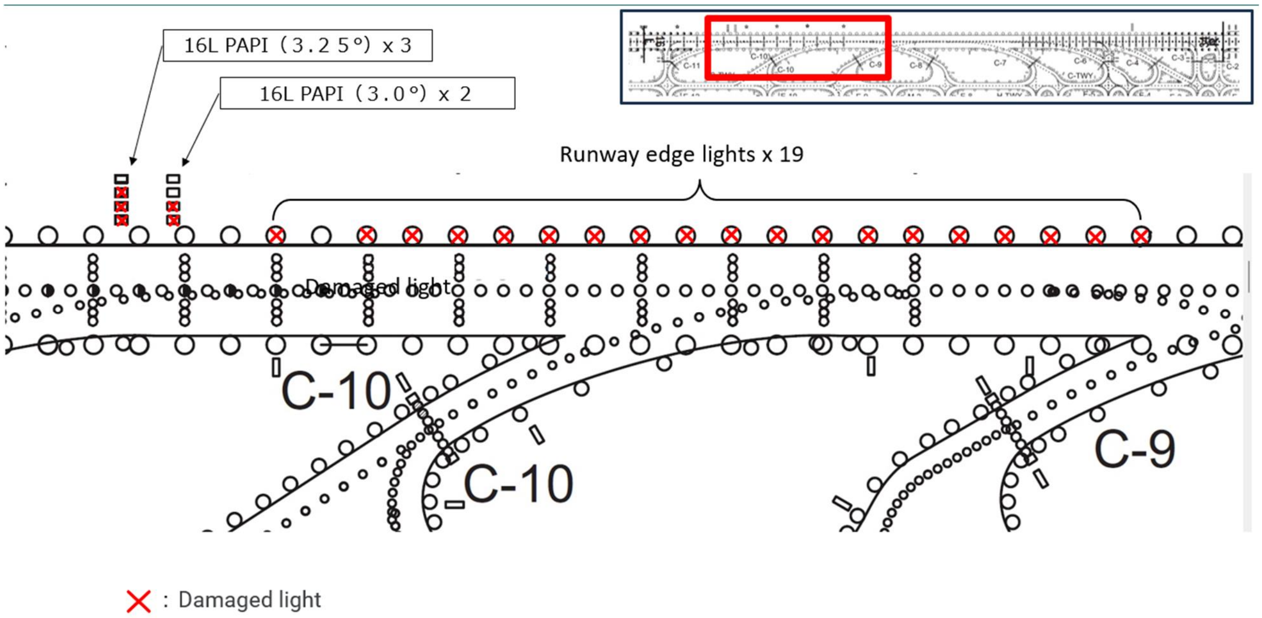
2.4.1 Aerodrome Lighting Aids

The aerodrome lighting aids damaged because of this accident are as follows (see Figures 10-1 and 10-2):

- Runway edge lights: 22 lights (damaged and covered in soot from fire)
- Runway centerline lights: 23 lights (covered in soot from fire)
- Runway touchdown zone lights: 27 lights (covered in soot from fire)
- PAPI for Runway 16L (3.0degrees): 2 lights (missing and displacement)
- PAPI for Runway 16L (3.25degrees): 3 lights (destroyed and missing)
- Centerline lights for Rapid exit taxiway 21 lights (covered in soot from fire)
- Taxiway centerline lights 4 lights (covered in soot from fire)



Figures 10-1 Damage to aerodrome lighting aids
(Near the collision site)



Figures 10-1　Damage to aerodrome lighting aids
(Northwest part of runway)

2.4.2 Runway facilities

Runway surface: Abrasions and damage to the pavement caused by fire (wrinkles, crunchiness)

A depression in the landing strip (green area) (length 200m, maximum width 1.7m, depth 0.7m)

2.5 Personnel Information

2.5.1 Aircraft A

(1) PIC A（1st Aviation Officer）　Age 39

Commercial pilot certificate (Airplane)	July 19, 2010
Pilot competency assessment Expiration date of piloting capable period Validity: July 19, 2010Type rating for Bombardier DHC-8	August 2, 2011
Instrument flight certificate (Airplane)	December 8, 2011
Class 1 aviation medical certificate Validity	March 21, 2024
Total flight time	2,951 hours 03 minutes
Flight time in the last 30 days	56 hours 34 minutes
Total flight time on the type of aircraft	1,345 hours 45 minutes
Flight time in the last 30 days	0 hours 00 minutes

(2) FO A（2nd Aviation Officer）　Age 41

Commercial pilot certificate (Airplane)	October 24, 2003
Pilot competency assessment Expiration date of piloting capable period Validity:March 28, 2024	
Type rating for Bombardier DHC-8	August 28, 2017
Instrument flight certificate (Airplane)	May 20, 2005
Class 1 aviation medical certificate Validity	October 13, 2024
Total flight time	6,049 hours 09 minutes

Flight time in the last 30 days 31 hours 03 minutes

Total flight time on the type of aircraft 535 hours 40 minutes

Flight time in the last 30 days 6 hours 30 minutes

(3) OBD Comm A（Communication Officer） Age 39

Flight experience 1 year and 9 months

(4) OBD RDR A(Search RADAR Officer） Age 39

Flight experience 5 years and 9 months

(5) OBD Maintenance A（Maintenance Officer） Age 47

Flight experience 12 years and 7 months

(6) OBD Airperson A（Maintenance personnel） Age 56

Flight experience 0 year 7 months

2.5.2 Aircraft B

(1) PIC B Age 50

Airline transport pilot certificate (Airplane) November 15, 2016

Pilot competency assessment

Expiration date of piloting capable period Validity: November 18, 2025

Type rating for Airbus A350 December 1, 2020

Class 1 aviation medical certificate Validity: March 21, 2024

Total flight time 12,662 hours 45 minutes

Flight time in the last 30 days 50 hours 17 minutes

Total flight time on the type of aircraft A350 1,071hours 06 minutes

Flight time of A350 in the last 30 days 50 hours 17 minutes

Final attendance of regular rescue training April 17, 2023

(2) Co-pilot Age 34

Multi-crew pilot certificate (Airplane) June 18, 2020

Pilot competency assessment

Expiration date of piloting capable period Validity: March 21, 2025

Type rating for Airbus A350 May 16, 2022

Class 1 aviation medical certificate Validity: March 21, 2024

Total flight time 2,135 hours 13 minutes

Flight time in the last 30 days 29 hours 00 minutes

Total flight time on the type of aircraft A350 678 hours 07 minutes

Flight time of A350 in the last 30 days 29 hours 00 minutes

Final attendance of regular rescue training December 15, 2023

(3) Training Crew Age 29

Commercial pilot certificate (Airplane) August 05, 2016

Pilot competency assessment

Expiration date of piloting capable period Validity: November 24, 2025

Type rating for Airbus A350 November 24, 2023

Instrument flight certificate March 17, 2017

Class 1 aviation medical certificate Validity: December 26, 2024

Total flight time 1,663 hours 04 minutes

Flight time in the last 30 days	24 hours 54 minutes
Total flight time on the type of aircraft A350	24 hours 54 minutes
Flight time of A350 in the last 30 days	24 hours 54 minutes
Final attendance of regular rescue training	January 17, 2023

(4) Chief cabin crewmember (L1) Age 56

Flight experience	35 years
Date of A350 qualification	November 06, 2020
Final attendance of regular rescue training	October17, 2023

(5) Cabin crewmember (L1') Age 30

Flight experience	10 years (Includes 3 years of experience at other companies)
Date of A350 qualification	December17, 2021
Final attendance of regular rescue training	September 04, 2023

(6) Cabin crewmember (R1) Age 27

Flight experience	4 years
Date of A350 qualification	February 15, 2022
Final attendance of regular rescue training	January 22, 2023

(7) Cabin crewmember (L2) Age 50

Flight experience	22 years
Date of A350 qualification	September 04, 2020
Final attendance of regular rescue training	January 12, 2023

(8) Cabin crewmember (R2) Age 26

Flight experience	0 years 4 months
Date of A350 qualification	August 15, 2023
Final attendance of regular rescue training	December 12, 2023

(9) Cabin crewmember (L3) Age 26

Flight experience	1 years 6 months (Includes 1 years of experience at other companies)
Date of A350 qualification	September 15, 2023
Final attendance of regular rescue training	December 18, 2023

(10) Cabin crewmember (R3) Age 27

Flight experience	0 years 3 months
Date of A350 qualification	October 16, 2023
Final attendance of regular rescue training	September 26, 2023

(11) Cabin crewmember (L4) Age 48

Flight experience	25 years
Date of A350 qualification	July 19, 2019
Final attendance of regular rescue training	January 22, 2023

(12) Cabin crewmember (R4) Age 25

Flight experience	0 years 3 months
Date of A350 qualification	October 15, 2023
Final attendance of regular rescue training	September 26, 2023

2.5.3 Air Traffic Controller

Tower East: Age 52	
Air Traffic Controller Certificate	July 1, 2004
Rating for Tokyo Airport Traffic Control Tower (Main)	October 7, 2009
Medical Certificate Validity:	January 30, 2024
Aviation English Language Proficiency Certificate	Validity: March 31, 2024

2.6 Aircraft Information

2.6.1 Aircraft A

(1) Aircraft

Type	Bombardier DHC-8-315
Serial number:	656
Date of manufacture:	September 16, 2008
Certificate of airworthiness	No.Toh-2023-255
Validity	October 28, 2024
Category of airworthiness	Airplane, Transporter T
Total flight time	7,911hours17minutes

(2) Engines

Type	Pratt and Whitney Canadian PW123E
Serial number:	No. 1 Engine (Left): PCE-AW0160
	No. 2 Engine (Right): PCE-AW0168
Date of manufacture:	No. 1 Engine (Left): April 8, 2009
	No. 2 Engine (Right): September 13, 2010
Total flight times	No. 1 Engine (Left): 6,015 h,10 m
	No. 2 Engine (Right): 4,820 h 7 m
Total number of use time	No. 1 Engine (Left): 2,378 cycles
	No. 2 Engine (Right): 1,762 cycles

(3) Weight and Balance

At the time of the accident, the weight of the Aircraft A was estimated to have been approximately 40,592lb and the position of the center of gravity (CG) was estimated to have been 28.0% MAC[18] , both of which were estimated to have been within allowable range (the maximum take-off weight of 43,000lb and CG of 20.3 to 40.0% MAC corresponding to the weight at the time of the accident).

(4) Fuel and Lubricating Oil

The fuel was Aviation JET A-1 and the lubricant (ASTMD1655), and the lubricating fuel was Aeroshell Turbine Oil 500 (MIL-PRF-23699).

(5) Exterior Lights

The exterior lights equipped on Aircraft A are shown in Figure 11-1.

*18 "MAC"(Mean Aerodynamic Chord , aerodynamic mean wing chord) refers to the hypothetical aerodynamically averaged wing chord (a straight line connecting the leading and trailing edges of the wing) over the entire wing.

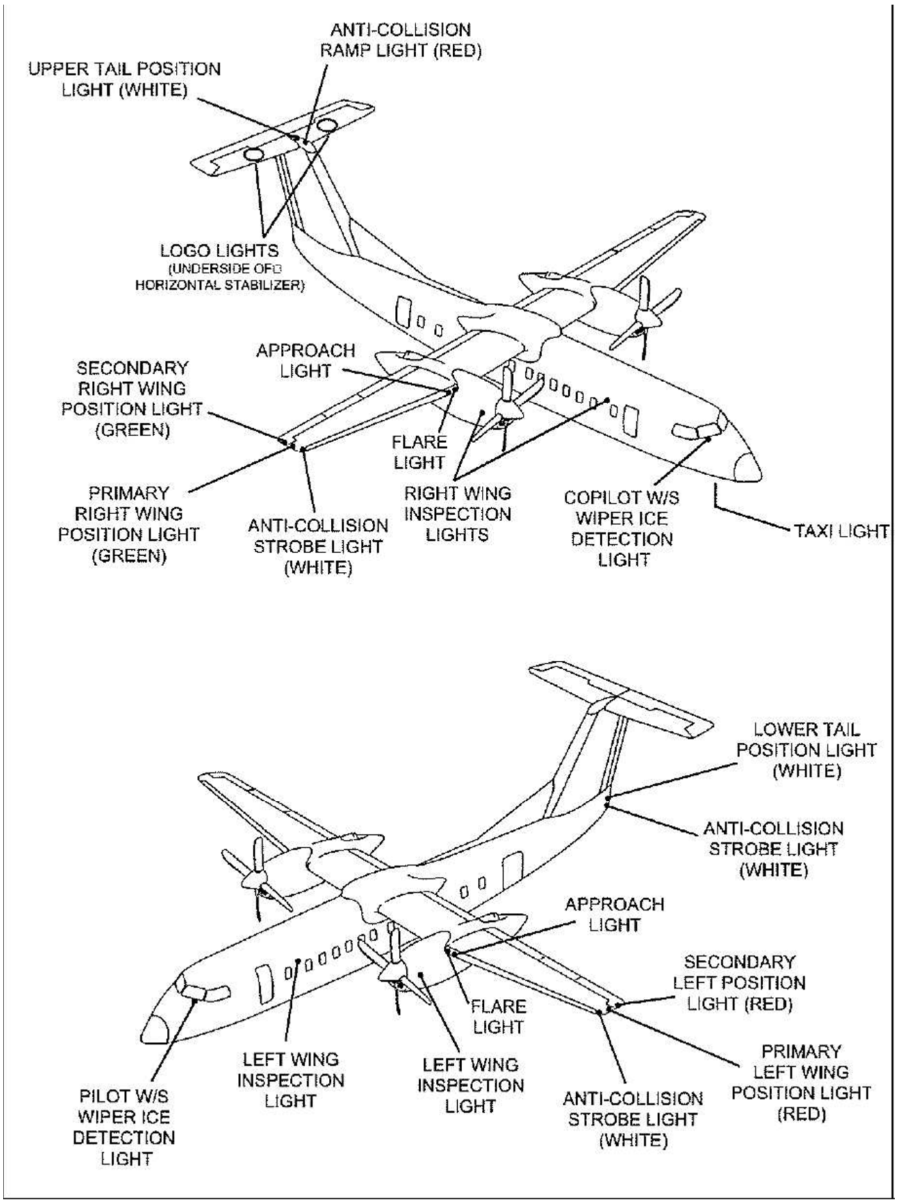


Figure11-1 Bombardier DHC-8-315Exterior Lighting Locations

Inspections of external lights are normally performed at the time of external, scheduled and annual inspections prior to each flight, and inspections of anti-collision light covers are performed at intervals of 5,000 flight hours or four years, whichever occurs first. The lens covers of the external lights are also inspected at the same time.

The external lights are operated by operating a switch located on the Overhead Panel in the upper center of the cockpit. Due to the structure of the switch (ANTI-COLLISION LIGHT SWITCH), the anti-collision lamp light (red strobe) and the anti-collision light (white strobe) in the center of the horizontal tail wing cannot be turned on simultaneously (see Figure 11-2). The anti-collision lamp light (red strobe) is to be turned on prior to the start of ground travel, and the anti-collision lamp light (white strobe) is to be turned off after receiving permission to enter the runway from the control authority (see 2.19.1.1(2)).

The airport surveillance camera footage confirms that these lights were turned on immediately prior to the accident.

Figure.11-2　DHC-8-315 External Light Operating Switch

2.6.2 Aircraft B

(1) Aircraft

Aircraft type:	Airbus A350-941
Serial number:	0538
Date of manufacture:	November 10, 2021
Airworthiness certificate:	No.Hon 2021-021

Validity: This Certificate is valid from November 11, 2021 and remains valid as long as the aircraft identified above is maintained in accordance with JAL Engineering Co., Ltd.'s continuing airworthiness maintenance program approved under Article 113-2 of the Civil Aeronautics Act.

Category of airworthiness:	Airplane, Transport T
Total flight time:	4,642 hours 49 minutes

Flight time since last periodical inspection (01C inspection: November 22, 2023)
285 hours 49 hours

(2) Engines

Type:	Rolls Royce Trent XWB-75	
Serial number:	No. 1 Engine (Left):	21929
	No. 2 Engine (Right):	21775
Date of manufacture:	No. 1 Engine (Left):	April 27, 2021
	No. 2 Engine (Right):	December 15, 2019
Total time in service:	No. 1 Engine (Left):	3,769 h 48 m
	No. 2 Engine (Right):	4,667 h 28 m

(3) Weight and Center of Gravity

At the time of the accident, the aircraft's weight was 370,552 lb, and the center of gravity (CG) was 25.4% MAC, both of which were within the operational limits for landing (the maximum landing weight of 456,355 lb, and CG 20.0 to 37.5 % MAC).

(4) Fuels and Lubricating Oil

The fuel used on the Aircraft was JET A-1, and the fuel onboard at the time of the accident was 14,350 lb.

The lubricating oil used in the Aircraft's engines was Mobil Jet Oil II, and the amount loaded at the time of engine start-up when the Aircraft departed from New Chitose Airport was 16.2 qt for the No. 1 engine and 17.2 qt for the No. 2 engine.

(5) Materials Used for the Main Structure

The A350 aircraft is a new large passenger aircraft in which approximately 53% of the material weight of the main structure, such as the fuselage and main wings, is made of carbon fiber reinforced plastics (hereinafter referred to as "CFRP"). CFRP is manufactured by laminating intermediate materials, called CFRP prepreg sheets, in which carbon fibers are aligned in one direction and impregnated with uncured, toughened epoxy*[19] that has thermoplastic resin*[20] particles, dispersed in it, in multiple directions, and then applying pressure and heat to harden them. A toughened epoxy layer is placed between each laminate to prevent delamination. The thickness of CFRP used in the airframe structure varies depending on the area where it is used (see Figure 12-1).

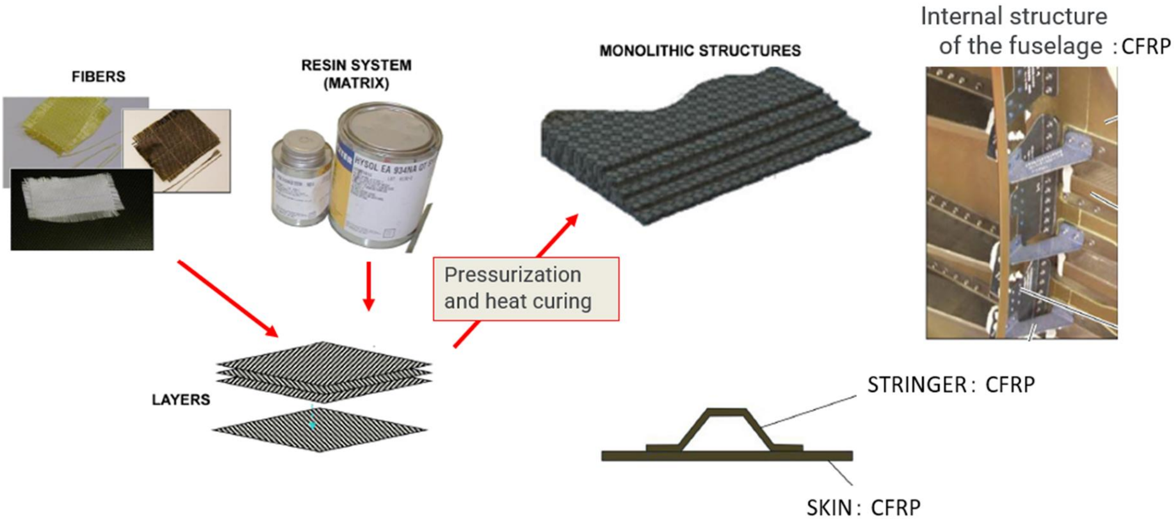


Figure 12-1 CFRP (additions to the diagram provided by Airbus)

The A350 aircraft has been built with the same strength as the conventional aircraft, with the main airframe structural members made of aluminum alloy. The cockpit structure was also made of aluminum alloy (see Figure 12-2).

*19 "High-toughness epoxy" refers to an epoxy resin whose heat resistance, elastic modulus, toughness, etc. have been improved by using a thermoplastic resin as a modifier.

*20 "Thermoplastic resin" is a resin that has the property of softening when heated and hardening when cooled.

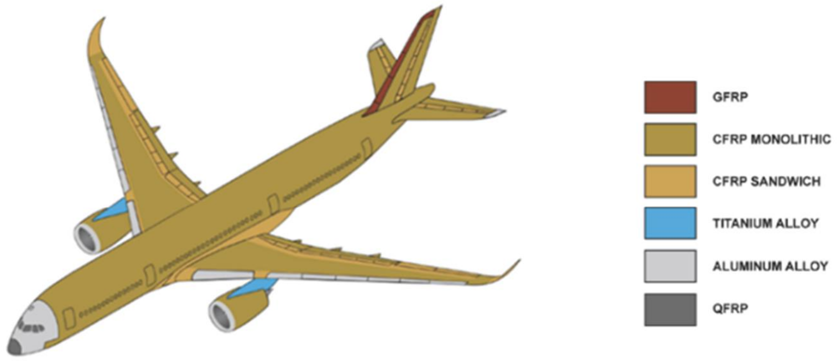


Figure 12-2 Materials of Aircraft B (provided by Airbus)

(6) Cockpit

The seating and instrument layout in the cockpit of the A350 aircraft is as shown in Figure 13-1.

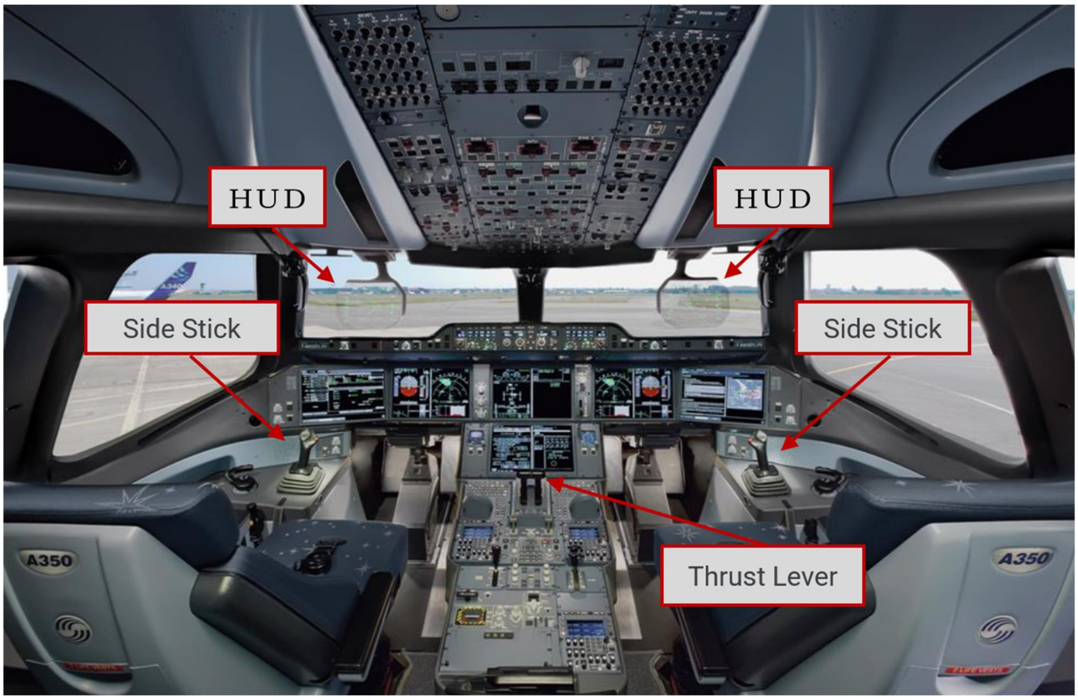


Figure 13-1: Cockpit of Airbus A350-900 Aircraft (Same Model as Aircraft B) (added from a diagram provided by Airbus)

The cockpit of Aircraft B was equipped with a HUD. The HUD is an electro-optical device that displays key flight information in the forward view of the cockpit, and is a transparent display device that mainly displays information related to the aircraft's trajectory and flight parameters overlaid on the outside world (see Figure 13-2).

Figure 13-2 Example of HUD Display (provided by Airbus)

In order to change the information content displayed on the HUD according to the flight situation, the system has a function to switch between three display levels: "Normal," "Declutter 1," and "Declutter 2." At the time of the accident, the flight crew members were using "Declutter 1". In addition, the system has a function to adjust the brightness of the symbols representing the displayed information.

In addition, on the A350, the HUD can be used at any times during flight (including taxiing), and the company's regulations permit its use at all times.

(7) Integrated Modular Avionics (IMA)

Instead of installing multiple electronic equipment, the A350 aircraft has adopted a system in which the functions of the equipment are integrated into applications, multiple functions are performed simultaneously on one computer, and these are shared, processed, and executed by multiple computers and a highly redundant dual network (called the AFDX Network on the A350 aircraft).

The module that processes and performs multiple functions using applications is called a Core Processing Input/Output Module (CPIOM), and the module that relays between the network and the aircraft system is called a Common Remote Data Concentrator (CRDC). The A350 aircraft has multiple of these and has multiple power supplies.

Except for important operations, operations performed through the switch panel are integrated as data in the CRDC, and the data is then transmitted to each system via the network (see Figure 14). However, this does not include important systems such as the engine fire extinguishing system which must operate even when the network is not operational.

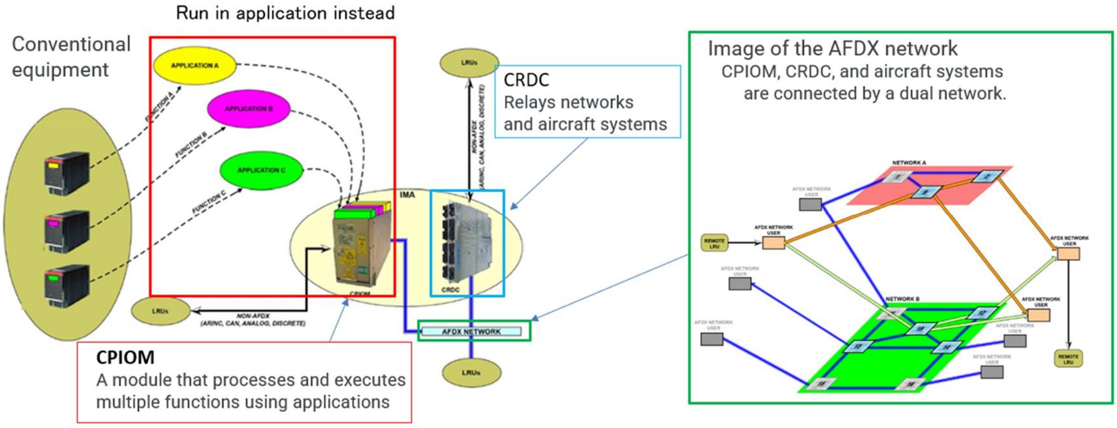


Figure 14: Outline of Integrated Avionics
(additions to diagram provided by Airbus)

(8) Electrical Power Generating and Distribution System

The layout of the Electrical power generating and distribution system of the A350 aircraft is as shown in Figure 15-1.

The Electrical power generating system is equipped with four 230V variable frequency generators (VFG), two on each of the left and right engines, as the main power source. In addition, there are the auxiliary power unit (APU) generator and ram air turbine (RAT) as other power sources.

The APU generator mainly supplies 230V AC power when the VFGs stop on the ground or in the air. When all engines stop working in the air or when the all the 230V AC buses loses power, the RAT deploys a wind turbine outside the aircraft and uses the airflow during flight to generate 230V AC power, which is then supplied to the emergency power distribution network. The 230V AC supplied by the generators on each engine is converted to 115V AC and 28V DC by a converter in the power distribution network and supplied to each BUS.

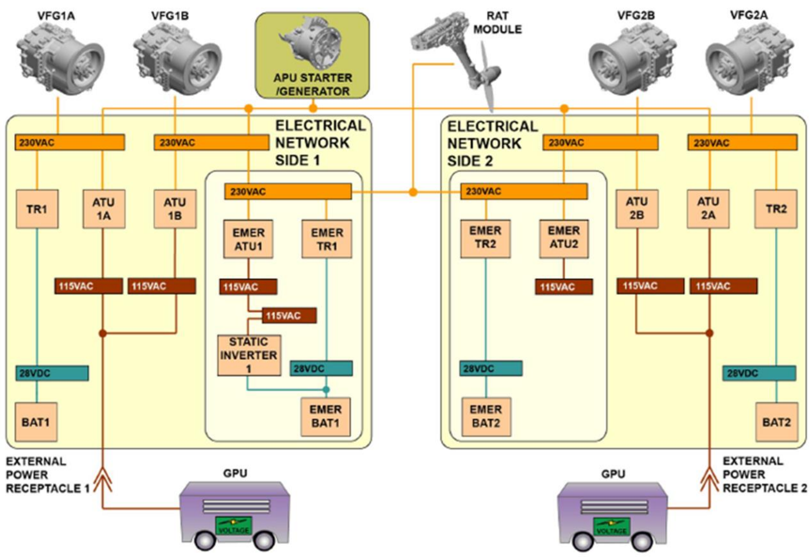


Figure 15-1 Electrical Power Generating and Distribution System
(additions to the diagram provided by Airbus)

Four batteries are installed, two of which are connected to the emergency power distribution network and mainly supply power to the aircraft when there is no AC power. The remaining two are connected when there is AC power in the main power distribution network. This is used to prevent temporary power loss when switching power sources.

The power distribution system consists of two power distribution networks called Side 1 and Side 2. Side 1 is equipped with an inverter, which converts DC power from the batteries into AC power when AC power is no more available, and supplies power to equipment that requires AC power. Side 2 is not equipped with an inverter.

The network is also divided into a main distribution network and an emergency distribution network, with critical systems receiving power from the emergency distribution network.

The main components of the power distribution system are located in two racks called Electrical Power Distribution Centers (hereinafter referred to as "EPDC") in the avionics compartment below the cockpit, and collect aircraft information via a network and control the entire power distribution system using multiple control boards (equivalent to computers) and network applications (see Figure 15-2).

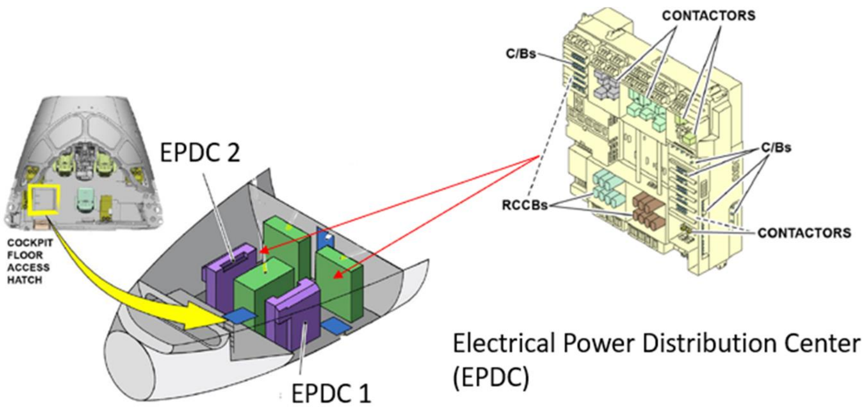


Figure 15-2 Electrical Power Distribution Center
(Additions to the diagram provided by Airbus)

(9) Flight Control System

The outline of the flight control system of the A350 aircraft is shown in Figure 16. Electronically controlled by Fly by Wire*21, a computer calculates input from the autopilot and flight crew to control the control surfaces.

Inputs from the side stick and rudder pedals during manual control, and from the flight guidance panel during autopilot, are calculated by three primary flight control computers (Primary Computer, hereinafter referred to as "PRIM") , and each control surface is moved based on the calculation results. If a problem occurs with the input data, three secondary flight control computers (Secondary Computer, hereinafter referred to as "SEC") supplement the data with the problem and move each control surface.

---

*21 "Fly by Wire" refers to a method of controlling the flight control surfaces using electrical signals without using traditional cables in the flight control system.

In addition, electrical actuators that can operate in the absence of hydraulic supply from the aircraft hydraulic system are built into the ailerons, elevators, and rudder, making it possible to move each control surface even if the aircraft hydraulic system is completely lost. In addition, even if PRIM and SEC are lost due to an abnormality in the power supply, the backup control system (Back up Control Module, hereinafter referred to as "BCM") will operate, securing the power required for control from a dedicated hydraulic generator, making it possible to move the minimum number of control surfaces and control the aircraft.

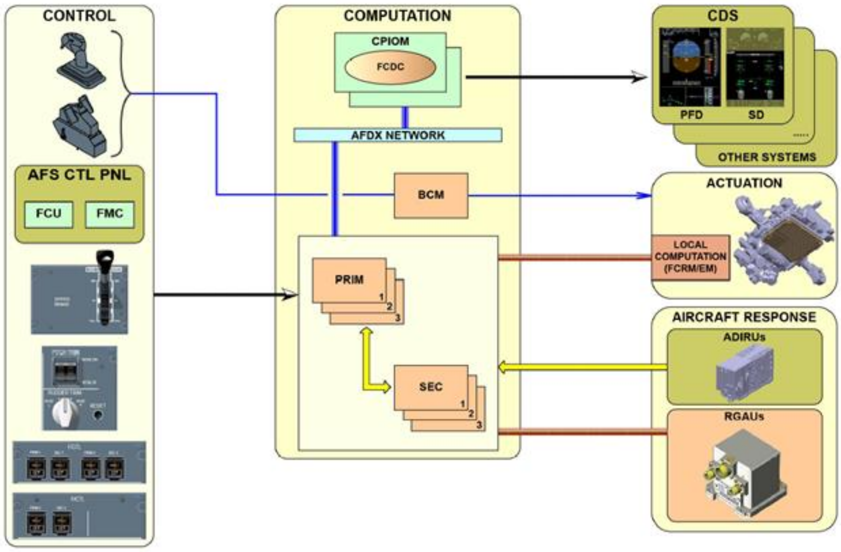


Figure 16: Schematic Diagram of the Flight Control System
(additions to the diagram provided by Airbus)

(10) Brake System

The A350 aircraft's brake system is outlined in Figure 17. The hydraulic pressure is electronically controlled in response to brake input, and the brakes are activated. When the flight crew depresses the brake pedal or the brake control application issues a command to activate the auto brake*22, the hydraulic control valve opens and supplies pressure to the eight hydraulic brakes on the main landing gear. When the brake pedal is depressed, the Brake Pedal Transmitter Unit (hereinafter referred to as "BPTU") transmits the input to both digital and analog circuits. Normally, the digital system (brake control application) issues activation command via a network controls, but in the event of a failure in the digital system, instructions are sent directly from the analog system.

*22 The "Auto Brake System" is a system that automatically applies the brakes during aborted takeoff and landing. When landing, if certain conditions are met after touchdown, the brakes are automatically applied at a deceleration rate according to the settings.

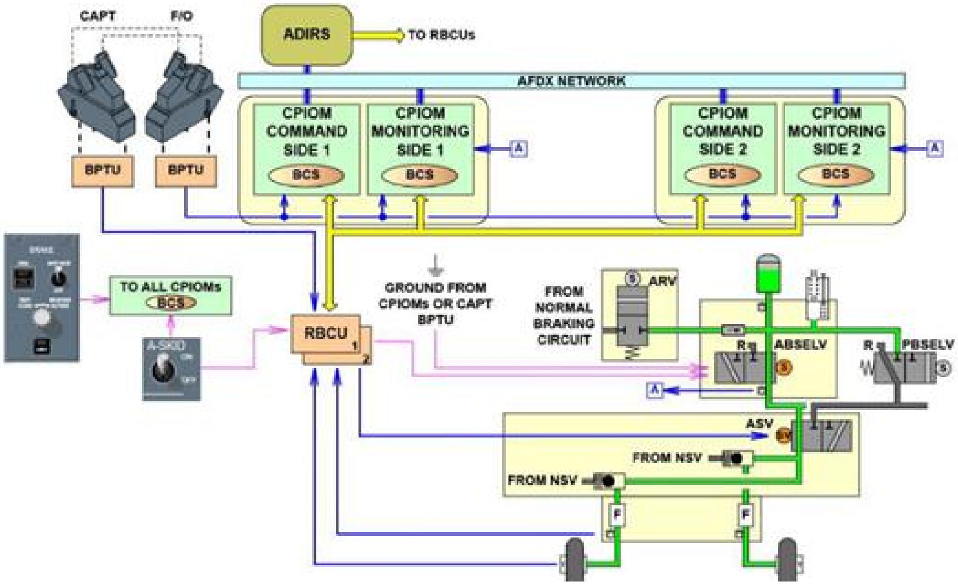


Figure 17: Schematic Diagram of the Brake System
(added from the diagram provided by Airbus)

(11) Engine Fuel System

The outline of the fuel system of the engine of the A350 aircraft is shown in Figure 18-1. Fuel supplied from the fuel tanks in the main wing is supplied to the engine through a low pressure shutoff valve (Low Pressure Shutoff Valve, hereinafter referred to as "LPSOV") installed on the wing front spar, upstream of the engine. The purpose of the LPSOV is to isolate the engine side fuel system from the aircraft in the event of a fire or engine stoppage. The fuel that passes through the LPSOV is pressurized by the fuel pump and supplied to the engine's fuel control system, where temperature control (heat exchange with oil) and adjustment to the required fuel flow rate are performed.

These controls are calculated and ordered by the Engine Electronic Controller (hereinafter referred to as "EEC"), which is attached at the 9 o'clock position of the engine fan case. In response to these instructions, the Hydro Mechanical Unit (hereinafter referred to as "HMU"), which is one of the engine's accessories, adjusts the fuel flow rate and others.

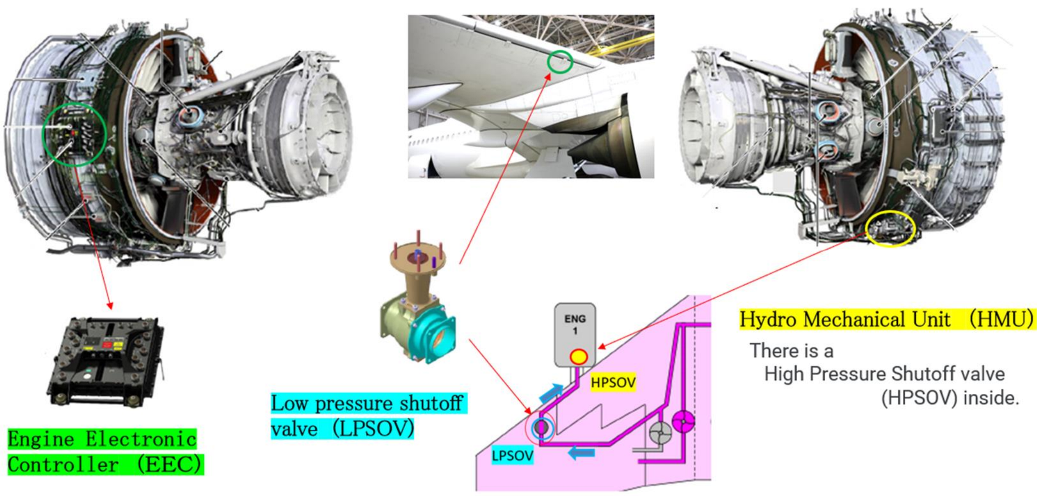


Figure 18-1 Engine Fuel System and Related Parts
(additions to the diagram provided by Airbus)

Inside the HMU is a High Pressure Shutoff Valve (High Pressure Shutoff Valve, hereinafter referred to as "HPSOV") that determines whether the fuel is turned on or off. This is directly controlled by the engine master switch in the cockpit, and is operated by the flight crew's engine start/stop operations. The engine master switch is also linked to the LPSOV, so when the engine master switch is turned OFF when the engine is stopped, the shutoff valves of both the HPSOV and LPSOV close. Closing the HPSOV shuts down the engine, and closing the LPSOV shuts down the engine and isolates the engine's fuel system from the aircraft (main wings).

The HPSOV is a solenoid type shutoff valve that is controlled by an electromagnetic valve and opens and closes with fuel pressure. When fuel pressure is lost, it closes with the force of a spring. On the other hand, the LPSOV shutoff valve opens and closes with an electric motor (see Figure 18-2). The LPSOV operates on 28V DC, and to ensure safety, it has two types of power supply, an emergency power supply and a normal power supply, and the circuit, including the motor, is doubled. These are controlled directly without going through a network.

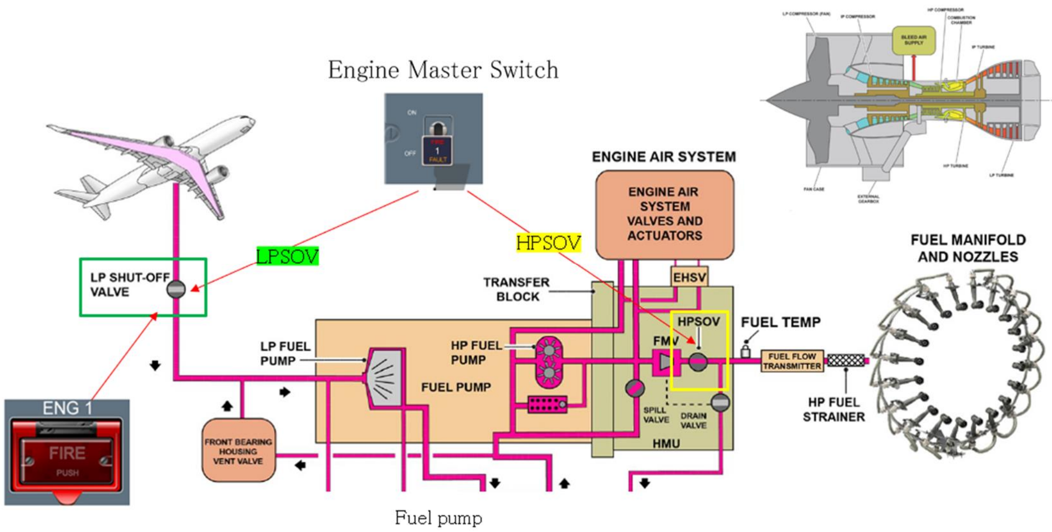


Figure 18-2 Schematic Diagram of Engine Fuel System
(additions to diagram provided by Airbus)

(12) Cabin Inter-Communication Data System

The A350 aircraft's cabin systems such as the intercom, in-flight public address system, and emergency evacuation instruction function (Emergency Evacuation Signaling, hereinafter referred to as "EVAC CMD") are integrated into the Cabin Inter-Communication Data System (hereinafter referred to as "CIDS"). CIDS also controls cabin signs and lights (seatbelt signs, and others.), cabin lighting, and other. The CIDS controller (CIDS Director) is the center of the system. It collects communications from the cockpit and aircraft information, determines the operation of the equipment it is responsible for, and transmits the data to multiple distributors (Decoder/Encoder Unit, hereinafter referred to as "DEU") installed in the cabin, which then activates the intercom handsets, lighting, and other in each section.

As these are important pieces of equipment that are needed in an emergency, two controllers are installed, and while one is controlling, the other is on standby and will take over in the event of a malfunction. In addition, the controllers and distributors use normal and emergency power sources, so that the equipment needed in an emergency is always powered on. (see Figure 19)

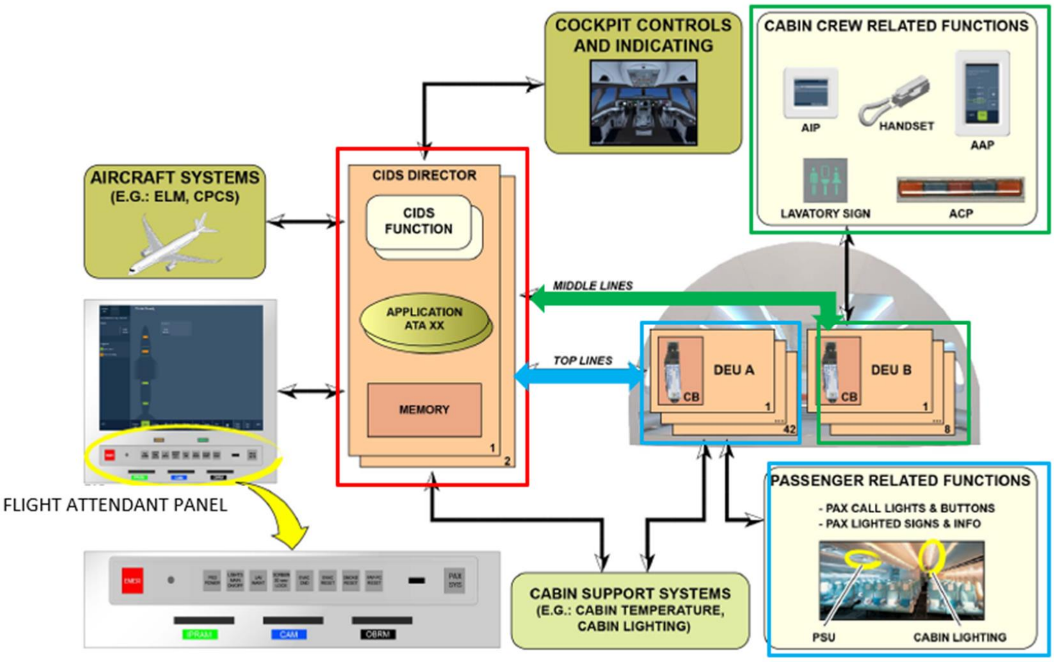


Figure 19: Schematic Diagram of Integrated Cabin communication Data System (additions to diagram provided by Airbus)

One of the functions of CIDS is the EVAC CMD. When activated when an evacuate decision is made, this system causes the horn and warning lights on all emergency doors to flash, informing the crew that a decision has been made to evacuate.

(13) Danger Areas with Engine Running

With respect to an engine operating at ground idle*23 on A 350 aircraft, the area within a radius of 4.6 m from the center of the engine air intake (engine forward) and within 67 m behind the engine exhaust port, as shown in Figure 20, is an area where there is a possibility of harm from the airflow sucked in by the engine and the engine exhaust flow. If the right escape slides R2, R3, and R4 had been deployed, they would all have been within the danger zone of the operating right engine. During the accident, the flight crew knew they were at risk and therefore did not open those escape slides.

*23 “Ground idle” means the minimum thrust state of the engine in operation that is selected on the ground. The lowest engine speed selected during operation..

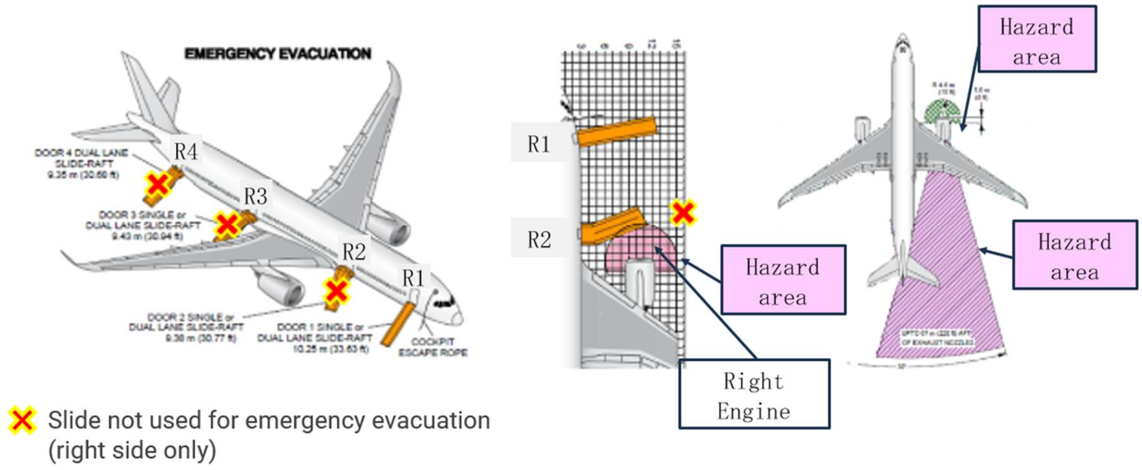


Figure 20: Location of the Hazard Areas around the Operating Engine and Escape Slides (Additions to the diagram provided by Airbus) (

2.6.3 Provisions of the Airworthiness Examination Standards for Aircraft Exterior Lighting

Airplanes (Airworthiness Standards : Transport Category Airplanes)

The provisions the Airworthiness Examination Standards for aircraft external lighting are as follows:

* The red framed area indicates the standard for light intensity when an aircraft on final approach looks backward at an aircraft on the runway.

6-4-6 Minimum luminous intensity in the horizontal plane of forward and rear Navigation lights The luminous intensity of each navigation light must be greater than or equal to the values shown in the following table.

2-face angle	The angle to the left or right of the aircraft's axis as it moves forward	Luminous Intensity (Candela)
L and R	From 0 to 10 degrees	40
	From 10 to 20 degrees	30
	From 20 to 110 degrees	5
A	From 110 to 180 degrees	20

6-4-7 Minimum luminous intensity in the vertical plane of forward and rear navigation lights The luminous intensity of each navigation light must be greater than or equal to the values shown in the following table.

Angle above or below horizontal	Luminous Intensity
0 degrees	1.00 I
From 0 to 5 degrees	0.90 I
From 5 to 10 degrees	0.80 I
From 10 to 15 degrees	0.70 I
From 15 to 20 degrees	0.50 I

6-4-11-6 Minimum effective light intensity for anti-collision light, etc.

The minimum effective light intensity for anti-collision light, etc. must be greater than or equal to the value in the following table.

Angle above or below horizontal	Luminous Intensity (Candela)
From 0 to 5 degrees	400
From 5 to 10 degrees	240
From 10 to 20 degrees	80
From 20 to 30 degrees	40
From 30 to 75 degrees	20

2.7 Information on Air Traffic Control (ATC)

2.7.1 ATC Services at Tokyo Airport Office

Tokyo Airport Office is staffed by air traffic controllers from Tokyo Airport Traffic Control Tower and Tokyo Radar Approach Control Facility. They do not work concurrently as a tower controller and a radar controller and provide 24-hour ATC services in shifts respectively. At the time of the accident, there were twelve air traffic controllers providing ATC services at Tokyo Airport Traffic Control Towe.

2.7.2 Operation Status of Runways and Taxiways

At the time of the accident, Haneda Airport was in 34 operations*24, with Runway 34R being used mainly for departure aircraft to the north and east and arrival aircraft from the same direction, Runway 34L (Runway A) mainly for arrival aircraft from the south and west and Runway 05 (Runway D) for departure aircraft to the same direction.

In addition, during 34 operations, Taxiway C is usually used for departure aircraft from Runway 34R, and Taxiway E is used for departure aircraft from Runway 05. However, prior to the accident, there was a towed aircraft that had moved north from Taxiway H via Taxiway E in front of Aircraft A, and another towed aircraft was scheduled to use Taxiway E, so aircraft departing from Runway 05 also used Taxiway C (see Figure 21-1, 21-2).

*24 "34 Operation" refers to the operation mode at Haneda Airport in which either or both of Runway 34L and Runway 34R are used as landing runways, and either or both of Runway 34R and Runway 05 are used as takeoff runways.

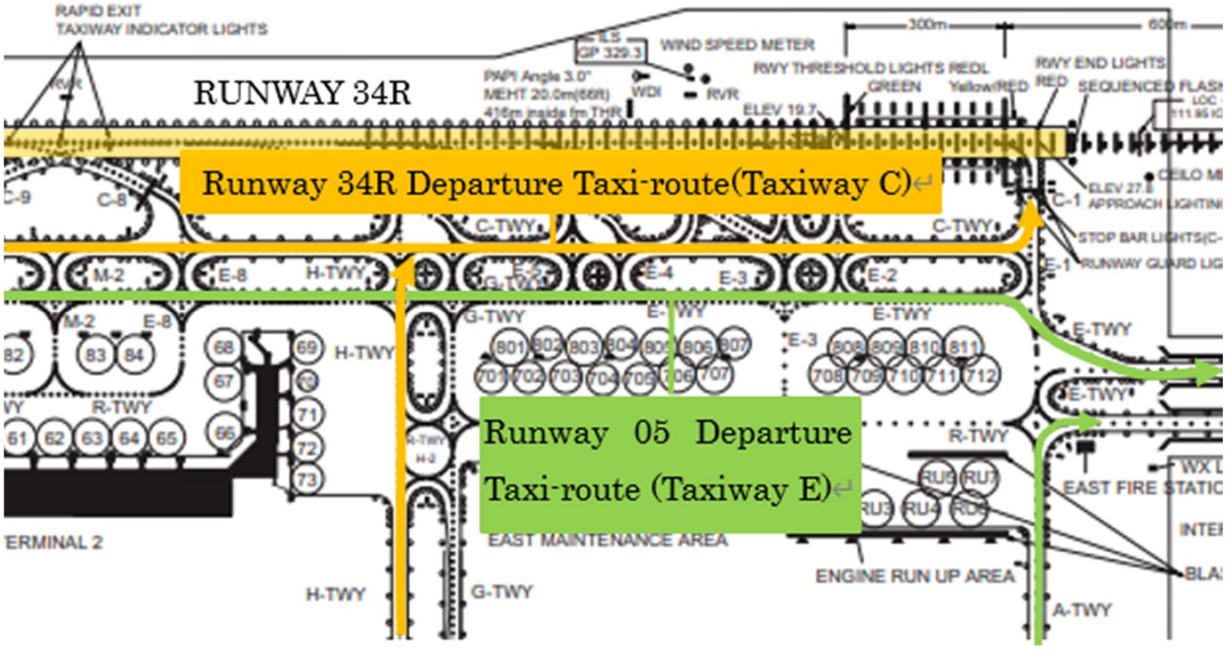


Figure 21-1 Normal Taxi-routes

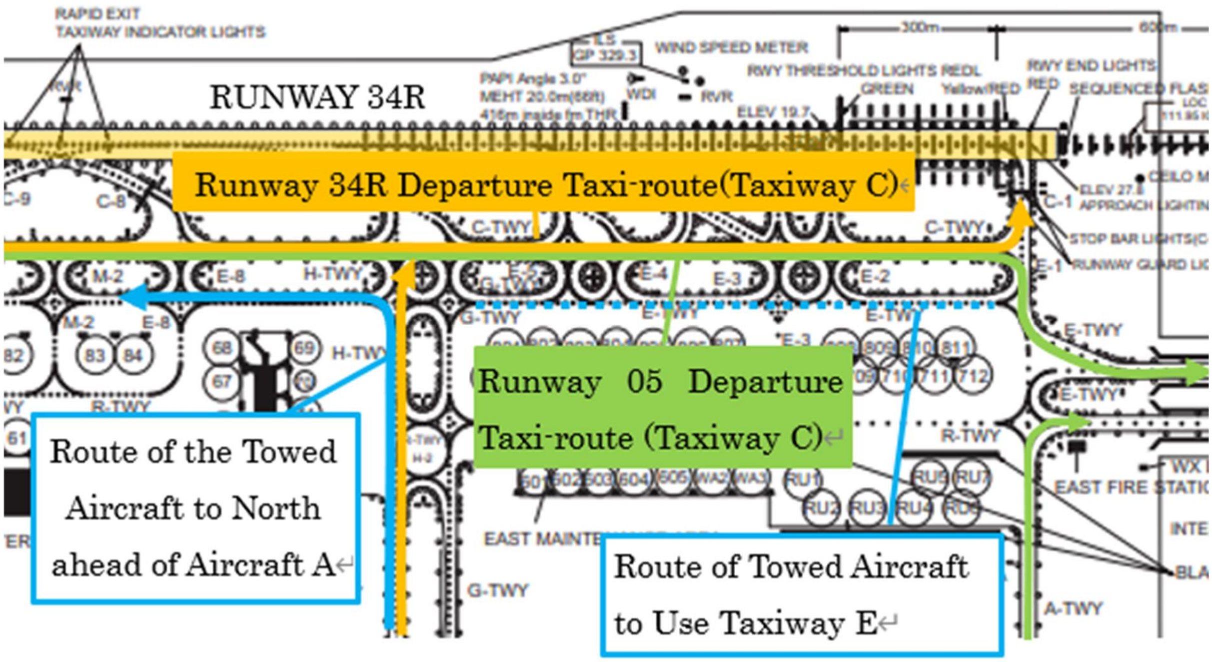


Figure 21-2 Taxi-routes before the Accident

2.7.3 Intersection Departure

At Haneda Airport, the air traffic controllers are more likely to instruct an aircraft departure aircraft from Runway 34R to make an intersection departure in the following cases.

1) When a pilot requests an intersection departure and the controller finds no obstacle to establishing separation from other aircraft

2) When successive departing aircraft are expected and the controller determines that the intersection departure of the leading aircraft can assist in the efficient establishment of separation from the following departure aircraft

3) When a departure aircraft, which is taxiing on the ground, is planned to take off before the approaching arrival aircraft for landing, and the controller determined that the departure aircraft can take off at the scheduled time by going through an intersection without taxiing to the end of the runway.

4) The controller clears a departure aircraft for takeoff in a different sequence from taxiing for some reason.

Intersection departures via Taxiways C2, C3 or C5 are excuted on a daily basis in accordance with controllers' instructions or pilots' requests. The total 593 aircraft excuded intersection departures via taxiway C5 for a period of 10 days in the year 2022 between October 17th and 21st and between December 12th and 16th, which was 26.7% of the Runway 34R departures.

2.7.4 ATC Phraseology and Procedures

2.7.4.1 Provision of Information regarding Takeoff Sequence

The III Standards for Air Traffic Control Procedures, Air Traffic Control Service Procedure Handbook set forth by the Civil Aviation Bureau (hereinafter referred to as "the ATC Standard"), stipulates that handling aircraft shall be handled on a first-come, first-served basis. However, at airports handling a large number of aircraft, takeoff, landing or departure/arrival sequences may be changed to ensure efficient use of the runway, taking into consideration the speed and weight of each aircraft, regardless of the sequence of call-in from the aircraft. Furthermore, departure aircraft may be subject to departure control time depending on congestion of its destination airport or estimated flight route, and the airport traffic control tower may change the takeoff sequences based on these control times. In this way, the air traffic controller of each control position makes the final decision based on the situation, therefore pilots are not be able to know the handling sequence of aircraft unless they are provided with the information by the air traffic controller.

The ATC Standard stipulates that landing sequences shall be decided by the airport traffic control tower, with the following stipulation as one of the phraseologies to instruct an arrival aircraft.

NUMBER [landing sequence number], FOLLOW [type and location of aircraft].
[Example] Number two, follow Twinbeech on base.

On the other hand, the ATC Standard does not stipulate procedures for deciding the takeoff sequences nor phraseologies for informing the departure aircraft of the takeoff sequences.

Furthermore, when airport traffic control tower provides pilots with information on handling sequences by numbers such as “number one”, “number two”, they inform arrival aircraft of their landing sequences and departure aircraft of their takeoff sequences, but does not provide a combined runway usage sequence for both.

2.7.4.2 Holding Short of Runway

The ATC Standard stipulates holding short of runway as follows.

In case it is unable to have aircraft enter runway due to traffic situation, an air traffic controller shall instruct it to hold short of the runway. In this case, the air traffic controller shall provide it with traffic information as required.

HOLD SHORT OF RUNWAY [number]. ([traffic information])

2.7.4.3 Procedures regarding Intersection Departure

The ATC Standard stipulates intersection departure as follows.

a In case an air traffic controller instructs intersection departure, the consent of the pilot shall be required, except in the case of the procedures described in AIP[*25] *etc.*

[Example] All Nippon 1843, do you accept C8B intersection departure?

All Nippon 1843, we accept C8B.

b (omitted)

c In case intersection departure is instructed or cleared and if unable to have aircraft enter the runway immediately, an air traffic controller shall instruct the aircraft to taxi to the runway holding point of the related interaction.

[Example] JAL3051, taxi to holding point A10.

JA001G, A2 intersection approved, taxi to holding point A2.

(omitted)

2.7.5 Traffic Volume and Flow Management at Haneda Airport

The average daily traffic volume at Haneda Airport in December 2023 was 1,318 aircraft, and on January 1, 2024, the day before the accident, the traffic volume was 1,345 aircraft. Figure 22 shows the hourly traffic volume on January 2, 2024. At the time of the accident, 17:47, it was a time when there were increasing number of arrivals and departures towards the evening peak hours of traffic.

*25 AIP stands for Aeronautical Information Publication, which is one of aeronautical information issued by the Civil Aviation Bureau in accordance with Article 99 of Civil Aeronautics Act of Japan and includes the latest permanent information essential for aircraft operations.

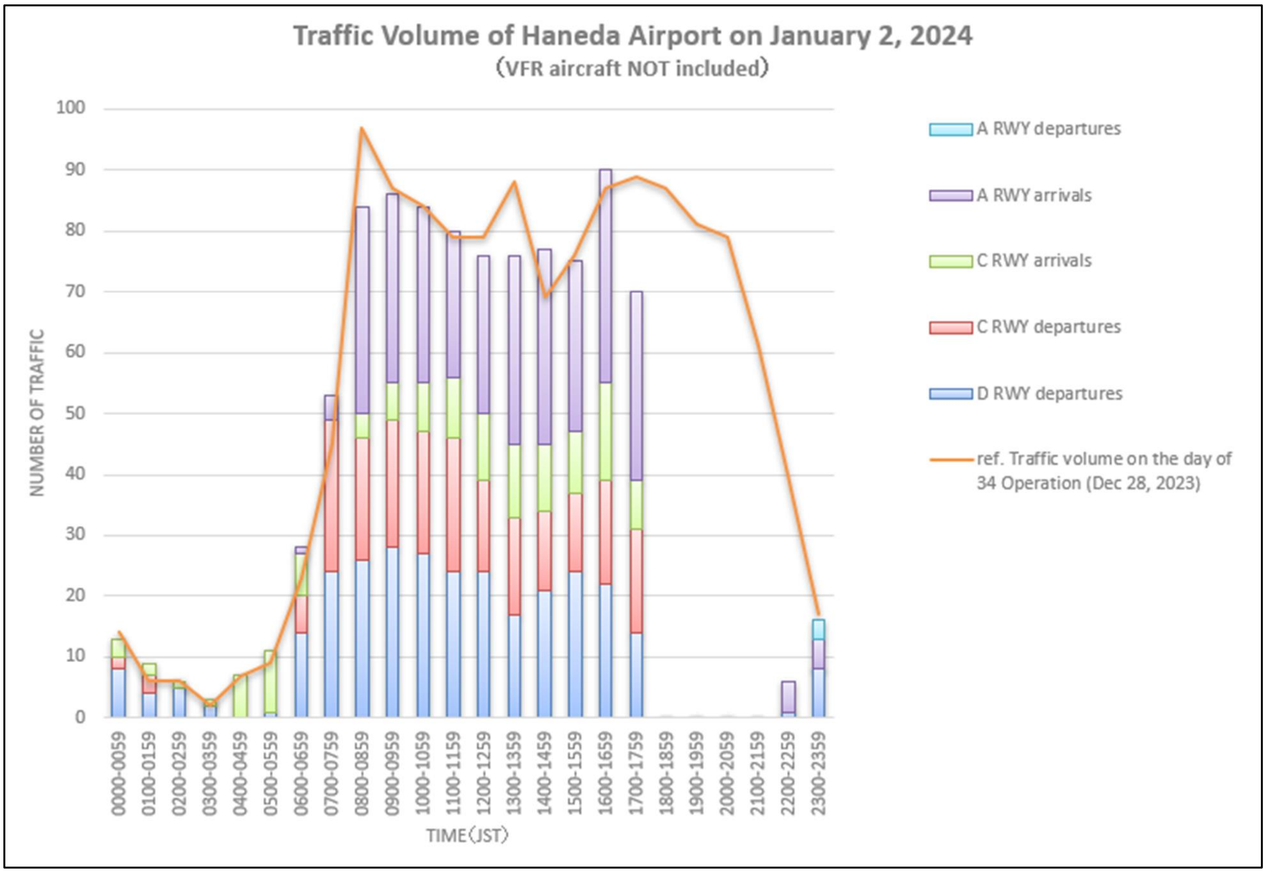


Figure 22 : Traffic Volume at Haneda Airport on the Day of the Accident

The following table shows the standard capacity value*26 of Haneda Airport which is determined by the Air Traffic Management Center (hereinafter referred to as the "ATM Center"*27), which provides ATM services for the entire Fukuoka Flight Information Region (FIR*28). The standard capacity value of Runway 34R is "15 aircraft per 30 minutes" and "13 or 14 minutes spacing time" *29

<table>
<tr><td rowspan="2">Airport</td><td colspan="4">Capacity Value (Standard)</td></tr>
<tr><td colspan="3">Runway related capacity (per 30 minutes)</td><td>Spacing Time related capacity</td></tr>
<tr><td rowspan="3">Haneda</td><td rowspan="3">Runway</td><td>34L & 22</td><td>16 aircraft</td><td rowspan="2">15 minutes</td></tr>
<tr><td>16L</td><td>15 aircraft</td></tr>
<tr><td>34R, 23 &16R</td><td>15 aircraft</td><td>13 or 14 minutes</td></tr>
</table>

*26 "Capacity Value" refers to the value of traffic volume per unit time concerning sectors, airways, approach control areas, runways, etc. which is determined by the ATM Center to manage ATC capacities appropriately.
*27 "ATM Center" refers to the facility of Civil Aviation Bureau (CAB), which is the provider of ATM services for the entire Fukuoka FIR. The facility configures appropriate flight routes by considering traffic and/or weather information in the airspace, monitors and coordinates traffic volume and conducts other ATM related services. The ATM Center was established in Fukuoka city in 2005.
*28 "Flight Information Region (FIR)" refers to the airspace of defined dimensions within which air traffic services (ATS) are provided by each Contracting State responsible for providing those services under the Convention on International Civil Aviation. In Japan, CAB provides ATS in Fukuoka FIR.
*29 "Spacing Time" refers to the acceptable time for ATC facilities to accommodate aircraft arriving at the airport within the approach control areas and the associated sectors by the instructions of holding-in-the-air, radar vectoring, etc.

The daily service logs of the ATM Center and its branch office at Haneda recorded the following air traffic flow management measures taken for Runway 34R arrival aircraft on January 2, 2024.

- In-flight Flow Control[*30] / RJTTN (15nm+250kt @LALID) … 16:15 ~ 16:50
- Number of aircraft to be allocated[*31] / RJTTN: 2 aircraft … 17:40 ~ 18:19

On the other hand, Tokyo Airport Traffic Control Tower and Tokyo Radar Approach Control Facility set up the following minimum separations for transfer of control over Runway 34R arrival aircraft from the radar to the tower under normal conditions:

Combination of '7nm' or '12nm', but do NOT apply '7nm' greater than or equal to three times consecutively

However, depending on the traffic situation, when it is necessary to increase or decrease the above separation, the tower and the radar are supposed to coordinate properly.

2.7.6 Operations at Tower Control Position when Aircraft A was Entering the Runway

While Aircraft A entered Runway 34R from Taxiway C5 and stopped there, three departure aircraft (Aircraft A, Aircraft C and Aircraft E) and two arrival aircraft (Aircraft B and Aircraft D) ware under the control of Tower East. In addition, on Taxiway C, two departure aircraft from Runway 05 (Runway D), which had not established communication with Tower East, were mixed with departure aircraft Tower East was responsible for.

Tower East was visually checking the positions and movements of these aircraft. In addition, as the two departure aircraft from Runway 05 were under control of Ground East, Tower East was also attempting to check the status of operations at Ground East.

As described in 2.1.2.2, during this time, Tower East received a request from AFS to shorten the separation between arrival aircraft, but declined it. At Haneda Airport, during 34 operations, in order to allow aircraft to take off from Runway 34R and Runway 05 between aircraft landing on Runway 34R, a minimum transfer interval from Tokyo Radar Approach Control Facility to Tokyo Airport Traffic Control Tower is set up as described in the previous section. As shown in Figure 22, the traffic volume on Runway 34R (Runway C) is such that there are more departure aircraft than arrival aircraft, the control transfer interval of 7nm shall not be repeated more than three times in a row. At that time, AFS thought that arrival aircraft approaching and descending from north toward Runway 34R in the area of Terminal Approach Control Facility was temporarily congested, making it difficult to allow them to approach within the specified control transfer interval. So, AFS used an override and considered the timing so as not to interfere with the operations at Tower East, requested that the 7nm transfer interval be applied three times in a row. At almost the same time, OA made a similar request to TC, and TC also declined the request.

*30 "In-flight Flow Control" refers to one of the flow control measures taken by the ATM Center through the issuance of restrictions pertaining to aircraft in-flight including the designation of entry interval to the sectors, approach control areas, etc. "RJTTN" indicates the traffic volume of aircraft arriving from the north of Haneda Airport, which is one of the airspace monitored by the ATM Center.

*31 "Allocating" refers to one of the flow control measures for the arrival traffic to Haneda airport. When traffic from the north is heavily congested and traffic from the south is light, and vice versa, the arrival routes and the landing runways are switched to the less congested ones for the appropriate number of aircraft to balance the demand.

Afterwards, Tower East heard a DF's voice over the hot microphone speaker asking what was happening to Aircraft B. At Tokyo Radar Approach Control Facility, DF makes coordination for departure aircraft while checking the airspace monitoring screen and the screen displaying the airport surface. When an aircraft makes a go-around, the DF receives report from the tower control position and provides instructions on the flight route, altitude, and frequency to be used, etc. At this time, Aircraft A, which was scheduled to take off after Aircraft B had landed in accordance with coordination with Tower East, appeared to be entering the runway on the screen displaying the airport surface, leading DF to wonder Aircraft B, which was on final approach, would make a go-around. However, as DF had not received any notification from the tower control position that Aircraft B would make a go-around, DF inquired about the status of Aircraft B to Tower East.

2.7.7 Runway Occupancy Monitoring Support System

(1) Objectives and Specification

The support system is a function installed in TAPS that monitors runway occupancy situations by acquiring positional information of aircraft and others on the airport surface via the airport surface detection radars and multilateration system and positional information of aircraft in the airspace via the airport surveillance radars etc. and issues a warning when runway occupancy overlaps. It was introduced in order to visually support air traffic controllers' situational awareness, according to the final report (March 2008) of "Runway Incursion Prevention Measures Review Committee" established by the Civil Aviation Bureau[*32]. When an overlapping runway occupancy condition is detected, the runway indication of the airport surface monitoring screen turns yellow along with the color change of data blocks[*33] of the related aircraft to visually alert air traffic controllers (see Figure 23). At the time of the accident, at the airport traffic control towers under the jurisdiction of the Civil Aviation Bureau, auditory alarming function (hereinafter referred to as "the sound alarm") was not mounted on the support system[*34].

At Tokyo Airport Traffic Control Tower, the support system has been in operation since fiscal 2010 and monitors the runway occupancy status of all four runways. Warnings by the support system are displayed on TAPS displays of all tower and ground control positions' consoles and the large monitor above the ground control position east (14 locations in total) at Tokyo Airport Traffic Control Tower, and necessary range (runway) for service by each control position is usually displayed (Example: At the control consols of tower control position east and ground control position east, Runway C should be displayed at minimum).

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*32 At the time of occurrence of the accident, the support system had been implemented, including Tokyo Airport Traffic Control Tower and Chitose Airport Traffic Control Tower (New Chitose Airport side) under the jurisdiction of Ministry of Defense, which uses its own system different from TAPS of the Civil Aviation Bureau, at airport traffic control towers at eight airports nationwide (New Chitose, Narita International, Haneda, Chubu Centrair International, Osaka International, Kansai International, Fukuoka and Naha).

*33 A "data block" refers to a set of information including the identification code and others for each aircraft displayed on the radar screen.

*34 At Chitose Airport Traffic Control Tower (New Chitose Airport side) under the jurisdiction of Ministry of Defense, a three-staged sound alarm (different sounds depending on the degree of risk) has been installed on the system similar to the support system of the Civil Aviation Bureau since the beginning of its implementation in 2013.

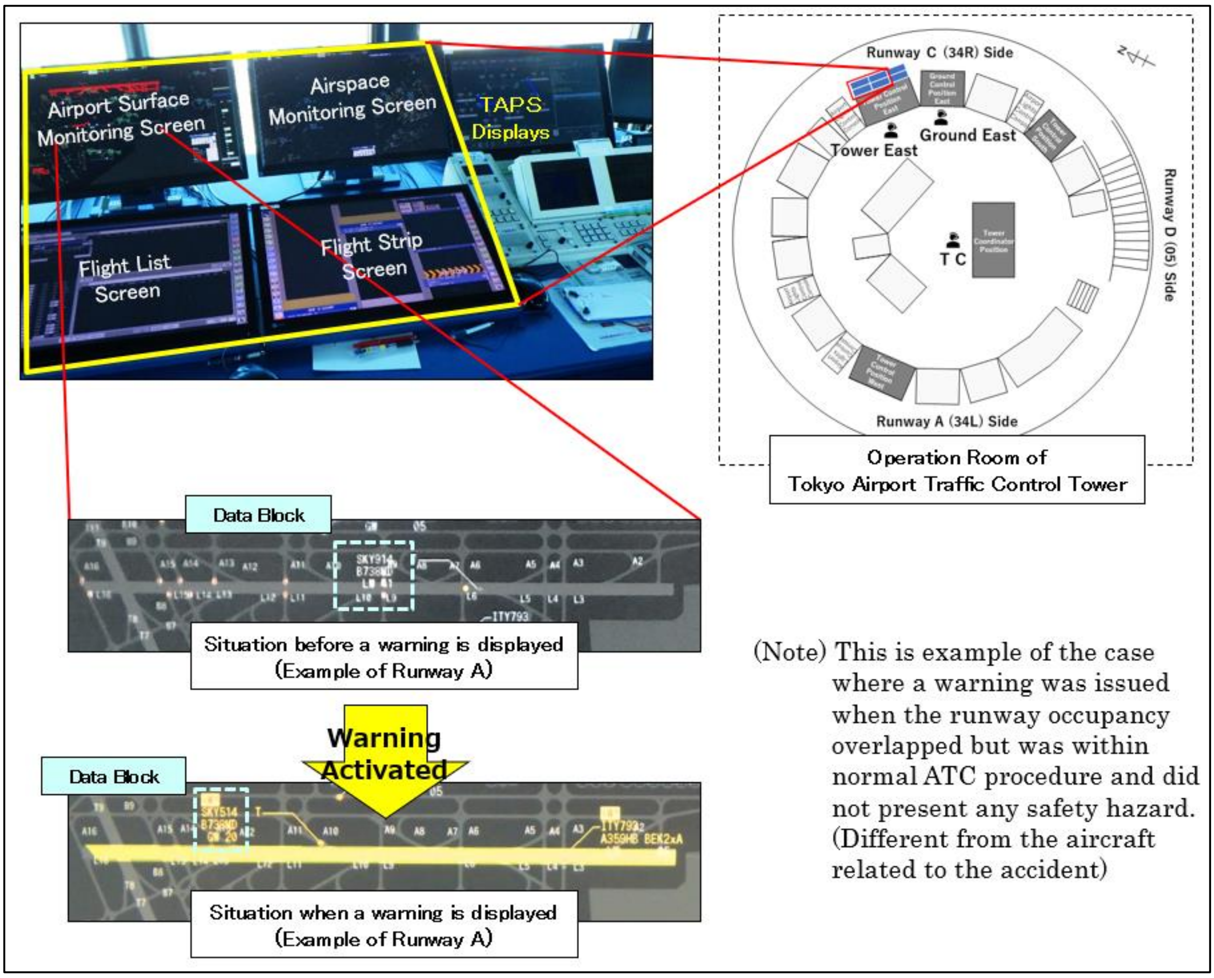

Figure 23: TAPS Display at Tokyo Airport Traffic Control Tower (Tower Control Position East) and the Image of the Warning Display for Runway Occupancy Monitoring Support System

At Haneda Airport, the support system issues a warning to an arrival aircraft when it is determined that other aircraft and others exist on the inside (runway side) of the runway holding point marking 48 seconds or later before the time when the arrival aircraft is expected to cross the runway threshold. For safety redundancy, the determination of runway occupancy situations takes into account a distance between its nose and the transmitting antenna of its ATC transponder of each aircraft type, as well as errors of the multilateration system. Due to this redundancy, the warning by the support system may be issued even when the runway occupancy does not actually overlap. In addition, when runway occupancies overlap but are within normal ATC procedure and do not present a safety hazard, the warning may be issued.

(2) Regulations and Materials relating to Handling

At the time of the accident, at Tokyo Airport Traffic Control Tower, there were no regulations stipulating how to handle situation when the warning by the support system was issued and no trainings based on the curriculum were conducted. In addition, there were no materials and others to provide air traffic controllers with knowledge of the principles behind the warnings by the support system.

(3) Operation and Warning Issuance Status

At the time of the accident, the support system was normally operative.

The operational logs of TAPS recorded that a warning by the support system was issued for Runway C at 17:46:20 and continued to be issued until 17:47:28. The warning was issued due to overlapping runway occupancy by Aircraft A and Aircraft B.

(4) Handling of Runway Occupancy Monitoring Support System by Air Traffic Controllers

Tower East had always found the support system difficult to reply on, as it sometimes displayed warnings even when runway occupancy was not actually overlapping and in addition there was no sound alarms, and did not consider it to be a system that would support visually situational awareness. Even when the accident occurred, Tower East did not recognize whether a warning by the support system was displayed or not.

Ground East also felt that the support system often displayed warnings in situations that had nothing to do with the actual runway occupancy status, and that it was incompetent as a system to support visually situational awareness. Even when the accident occurred, Ground East did not recall any warnings by the support system being displayed.

TC also considered, as the same reason as Tower East and Ground East, that it did not function as a support system, and normally did not expect to take any action even if TC saw a displayed warning. Even when the accident occurred, TC did not recall seeing a displayed warning by the support system.

2.8 Weather and Astronomical Data

2.8.1 Aerodrome Routine Metrological Report (METER) of Haneda Airport

17:30 (JST)　Wind direction Variable ; Wind velocity 3 kt; Visibility 10 km or more
Cloud: Amount 1/8, Type Stratus, Cloud base 2,000 ft
Cloud: Amount 4/8, Type Cumulus, Cloud base 9,000 ft
Temperature 8°C, Dew point 4°C,
Altimeter setting (QNH) 1,016hPa / 30.02 inHg

18:00 (JST)　Wind direction 330° Wind velocity 8 kt; Visibility 10 km or more
Cloud:　Amount 1/8, Type Stratus, Cloud base 2,000 ft
Temperature 7°C, Dew point 4°C,
Altimeter setting (QNH) 1,016hPa / 30.03 inHg

2.8.2 Special Observation at Accident of Haneda Airport

17:54 (JST)　Wind direction 340° Wind velocity 7 kt; Wind direction variable 300°–360°; Visibility 30 km
Cloud: Amount 1/8~2/8, Type Stratus, Cloud base 2,000 ft
Temperature 7°C, Dew point 4°C
Altimeter setting (QNH) 1,016hPa / 30.03 inHg

2.8.3 Astronomical Data

The times of sunset, end of civil twilight*35, moonset and moonrise at Haneda Airport on January 2nd were as follows:

Sunset : 16:39
End of civil twilight: 17:07
Moonset: 10:37
Moonrise: 22:27

The times of sunset and civil twilight at New Chitose Airport on the same day were as follows:

Sunset: 16:11
End of civil twilight: 16:42

2.9 Information regarding Aeronautical Navigation Aids

2.9.1 Aerodrome Lights not in Operation at the Time of the Accident

2.9.1.1 Stop Bar Lights

Stop bar lights are installed on Runway C of Haneda Airport, but the operation had been suspended due to construction work to renew the aged stop par control system (see Figure 24).

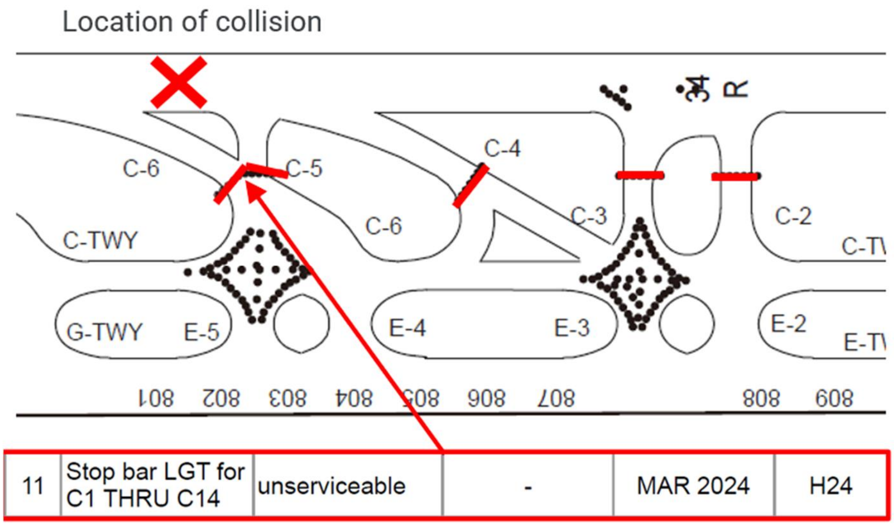

Figure 24: Location of the Out-of-service Stop Bar Lights
(near the taxiway where Aircraft A passed)

Besides, stop bar lights may be operated when the visibility is at or below 600 m, or when visibility is expected to lower and air traffic controllers deem it necessary (Japan Civil Aviation Bureau, III Operation Standards, Visual Aids and Electrical Systems Service Procedure Handbook, 7-13).

During the operation of the stop bar lights at Haneda Airport, departure aircraft taking off from Runway C are required to enter the runway via any one of the specific taxiways (C1, C2, C13 and C14), therefore the lights on those taxiways only can be respectively turned off. Air traffic controllers of the Tokyo Airport Traffic Control Tower accordingly turns off these lights

*35 The end of civil twilight is the time when the sun's altitude is -6°. Between sunset and this time, there is enough light to be able to be active outdoors.

while issuing the clearance for runway entry to the departure aircraft on a case-by-case basis. As for the stop bar lights of the other taxiways, the lights are steadily on, as departure aircraft never use the taxiways for runway entry.

2.9.1.2 Other Aeronautical Lighting

Due to construction work (runway pavement repairs, etc.), some of the runway center line lights, some of the ground zone lights and some of the taxiway center line lights were out of service (see Figure 25).

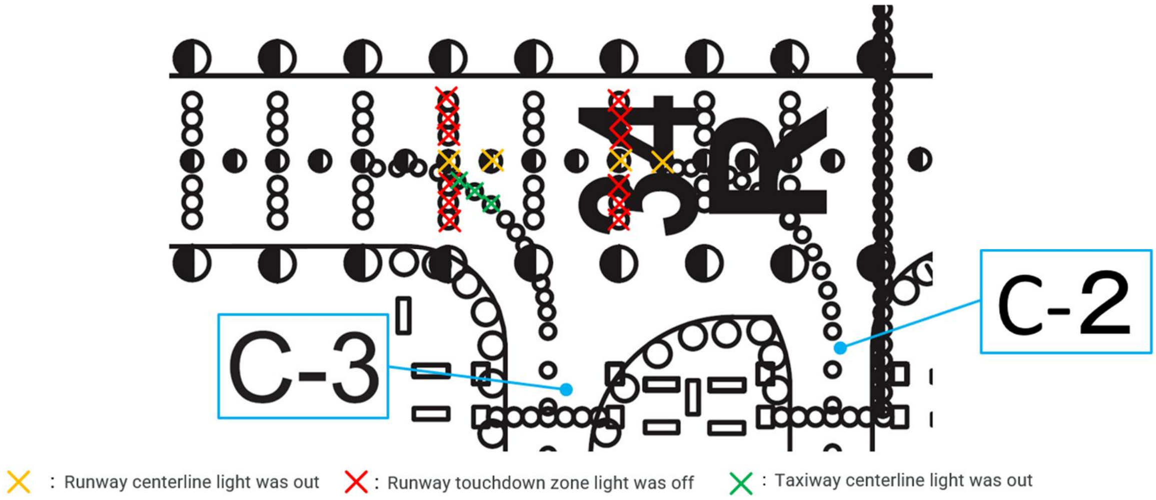

Figure 25: Runway Centerline Lights, etc. that were out of Operation

2.9.2 Luminance Settings of Airport Lights Installed on Runway C

The luminance settings of airport lights at the time of the accident were as shown in Table 1. The luminance of each light at the time of the accident, listed in the rightmost column, is the value calculated based on the dimming setting (TAP) at the time from the luminance of each light shown in the notice.

Table 1: Luminance of Aerodrome Lighting Aids at the Time of the Accident

Description	color	Standard	Type	LED	Notice of luminosity	TAP	Luminous ratio	Luminous Intensity(cd)
Approach lighting system	Variable White	EHU-31D	Elevated	LED	21,000	1	0.20%	**42**
	Variable White	LU3-1D	Inset	LED	21,000	1	0.20%	**48**
	Red	LU3-2D	Inset	LED	8,400	1	0.20%	**17**
Sequenced flashing lights	White flash	FX-AV-01	Elevated	Discharge lamp	19,000	1	2.25%	**428**
Precision approach path indicator	Variable White	P	Elevated	–	100,000	3	10.00%	**10,000**
	Red	P	Elevated	–	17,000	3	1.00%	**1,700**
Runway edge lights	Variable White	EHB-35	Elevated	–	15,000	2	1.00%	**150**
	Variable White	FHB-36	Inset	–	12,000	2	1.00%	**120**
	Red	EHB-35	Elevated	–	2,300	2	1.00%	**23**
Runway threshold lights	Green	EHU-32	Elevated	–	10,000	2	1.00%	**100**
		LU3-3	Inset	–	11,000	2	1.00%	**110**
Wing bar lights	Green	EHU-31	Elevated	–	10,000	2	1.00%	**100**
		LU3-2	Inset	–	15,000	2	1.00%	**150**
Runway center line lights	Variable White	FMB-37	Inset	-	69,00	1	0.20%	**14**
Runway Touchdown zone lights	White	FMU-38	Inset	–	6,000	1	0.20%	**12**

2.9.3 Location of the Runway Touchdown Zone Lights and Runway Centerline Lights Installed on Runway C

The locations of the runway touchdown zone lights and runway centerline lights installed on Runway C (approach end of Runway 34R) are as shown in Figure 26.

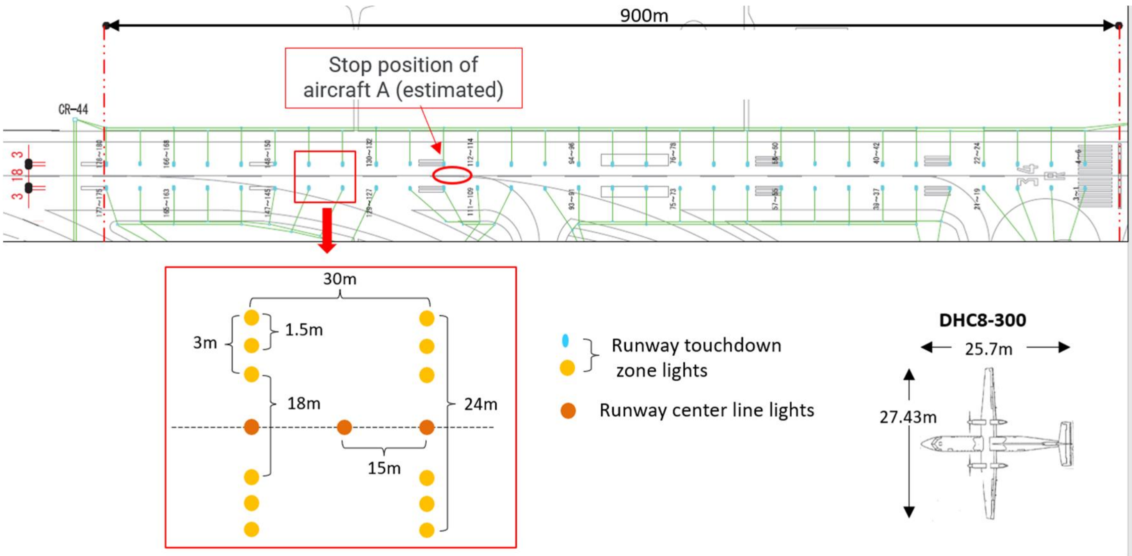

Figure 26: Location of Runway Touchdown Zone Lights and Runway Centerline Lights

2.10 Communications Information

All air safety radio facilities installed at Haneda Airport were operating normally at the time of the accident.

2.11 Information about airports and Airport facilities

At the time of the accident, there were no incidents that would have disrupted aircraft operations, and the airport and Airport facilities were operating normally.

2.11.2 Impact of the accident

(1) Runway Closure

January 2nd, after the accident, all runways closed
21:29, Runway A, Runway B and Runway D resumed operation

January 8th, 00:00, Runway C resumed operation

(2) Taxiway Closure

Table 2 shows the status of taxiway closures due to the accident.

Table 2 Taxiway Closure Status

taxiway	Closure Period
C1 ～ C14	January 2nd 18:30 ~ January 8th 00:00
Taxiway C (Between C1 and C14)	January 2nd 20:44 ~ January 4th 11:18
Taxiway C (Between C1 and G)	January 4th 11:18 ~ January 7th 10:48
E1 ～ E5	January 4th 11:21 ~ January 7th 10:48
Taxiway G (Between C and H2 cross point)	January 2nd 18:53 ~ January 3rd 09:56

(3) Cancellations and Delays of Scheduled Flights

The number of cancellations and delays of scheduled flights due to the accident is as shown in Table 3.

Table 3: Number of cancelled and delayed scheduled flights

Date	Cancelled		delay	other
	departure	arrival		
January 2	134	214	34	Divert: 51
January 3	164	121	744	
January 4	110	126	811	
January 5	104	113	669	
January 6	108	107	537	
January 7	105	106	537	
January 8	11	11	180	

2.12 Information on Flight Recorders

2.12.1 Aircraft A

Aircraft A was equipped with an FDR manufactured by L3 Communications of the United States of America, capable of recording for approximately 25 hours, and a CVR manufactured by Honeywell of the United States of America, capable of recording for approximately 2 hours.

The FDR was recovered with its outer case and internal electronic boards damaged, but the part containing the recording medium that recorded the FDR data (hereinafter referred to as the "CSMU") was not damaged.

The FDR contained records from the time the Aircraft A started taxiing from the parking area to the time it was estimated to have collided with Aircraft B. Some of the parameters that should be recorded in the FDR (Throttle Lever Position) was not recorded correctly.

The CVR was recovered with the CSMU that recorded the audio separated from the other parts. The outer case and the internal electronic board were damaged. The recording medium that recorded the audio had a burnt signal line, which was repaired, and the recording data was retrieved.

The CVR recorded audio from the time the Aircraft A started taxiing from the parking area to the time it was estimated to have collided with Aircraft B.

Time correction of the FDR and CVR was performed by matching the time signal recorded in the air traffic control communication record with the VHF radio transmission signal recorded in the FDR and the air traffic control communication recorded in the CVR.

2.12.2 Aircraft B

Aircraft B was equipped with an FDR manufactured by L3 Harris of the United States of America, capable of recording for approximately 25 hours, and a CVR manufactured by L3 Harris, capable of recording for approximately 25 hours.

The FDR was recovered with its outer case and internal electronic boards burned. The recording medium that recorded the FDR data had a damaged connector to which the signal line was connected, so this was repaired, and the records were retrieved.

The FDR contained records from the Aircraft B takeoff from New Chitose Airport to the time it was estimated to have collided with Aircraft A.

The CVR was severely burned around the area, so the outer case was burned along with the storage rack, and only the CSMU, which recorded the audio, was recovered. No internal electronic board other than the CSMU could be found. The recording medium that recorded the audio was not damaged.

The CVR contained records from the aircraft's takeoff from New Chitose Airport to the Aircraft B stopped after colliding with Aircraft A.

The time correction of the FDR and CVR was performed by matching the time signal recorded in the air traffic control communication record with the VHF radio transmission signal recorded in the FDR and the air traffic control communication recorded in the CVR.

2.12.3 Condition of the Flight Recorder at the Time of Recovery

The condition of the flight recorders of Aircraft A and B when they were recovered is as shown in Figure 27.

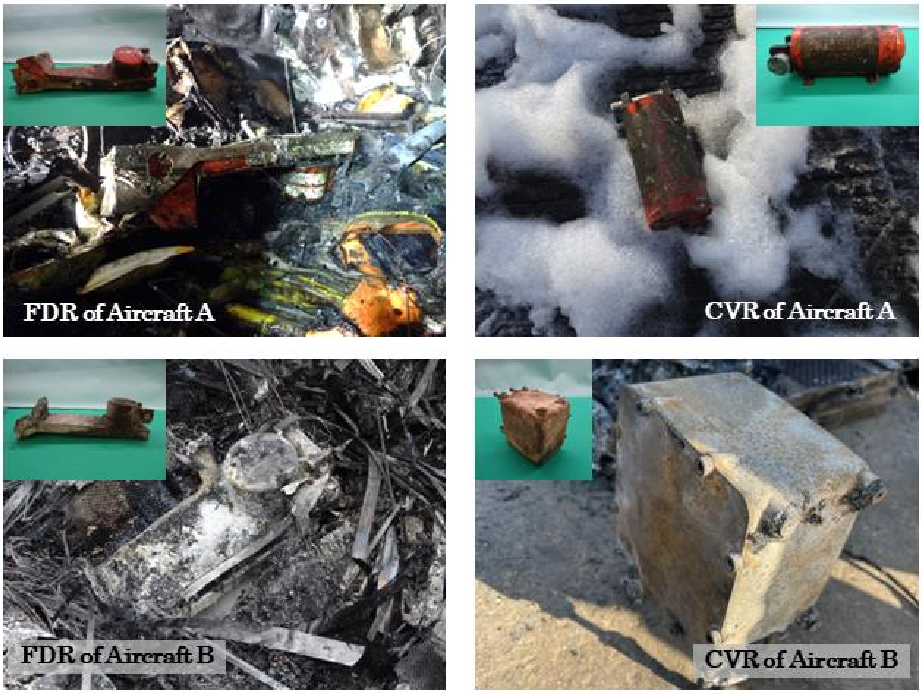

Figure 27 : The condition of the flight recorders

2.12.4 Parameters not Recorded in Aircraft A's FDR

As described in 2.12.1, some of the FDR records for Aircraft A were not recorded correctly, so the JTSB investigated the FDR records that it had previously obtained by JCG for the same type of aircraft, the DHC-8-315, and found that, as with Aircraft A, some of the parameters were not recorded correctly on some of the aircrafts, as was the case with Aircraft A.

In the inspection records at the time of manufacturing Aircraft A, the parameters in question were recorded correctly.

2.13 Accident Site and Wreckage Information

2.13.1 Accident Site

Wreckage from both aircraft was scattered on Runway C from where Aircraft A was estimated to have stopped to where Aircraft B stopped, and on the grass beside the runway (see Appendix 2).

The runway surface was scorched from the area where Aircraft A and B collided to where the remains of Aircraft A's fuselage were found (see Figure 28).

A line of abrasion marks remained on the runway from the collision point to where Aircraft B had stopped. The abrasion marks were connected to tracks made by the nose landing gear strut of Aircraft B in the grass beside the runway. In the grass where Aircraft B had run off the runway, there were tracks made by the nose and main landing gear, as well as abrasions caused when both engines came into contact with the grass (see Figure 29).

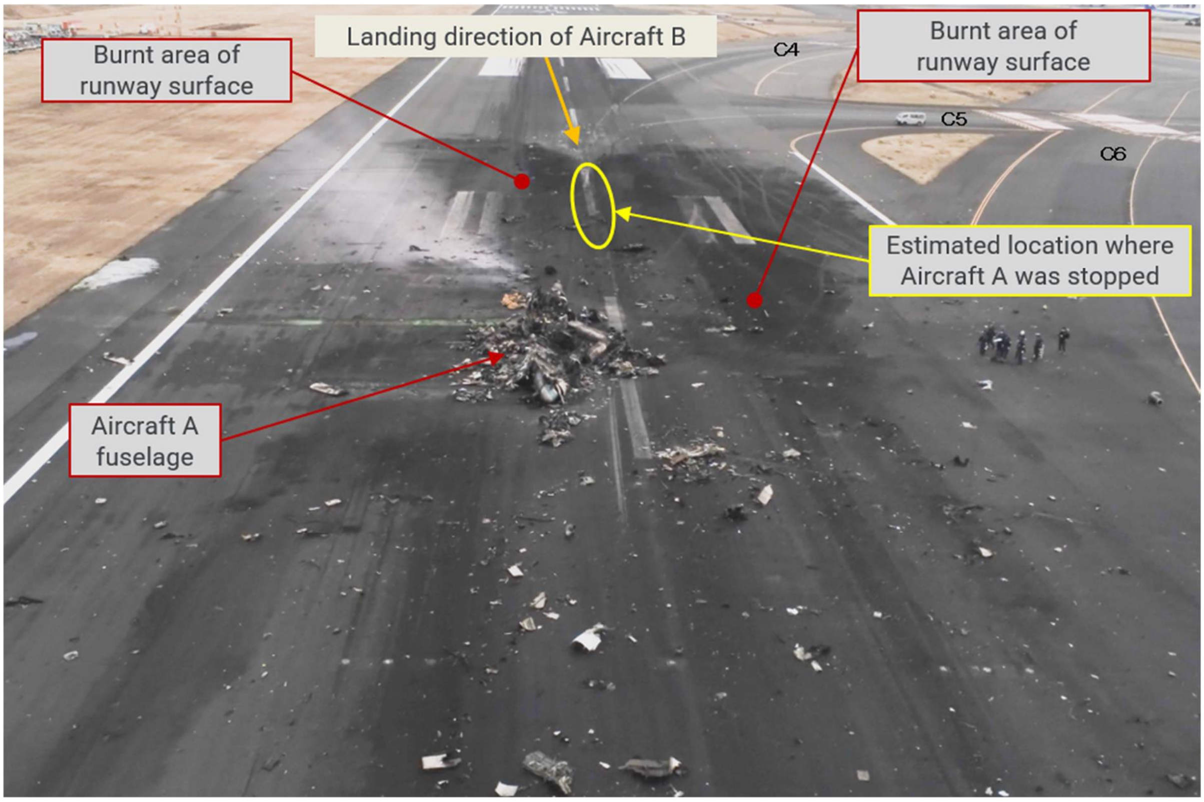

Figure 28: The Scene where Aircraft A and B Collided

Figure 29: Track Traces after Aircraft B Deviated from the Runway

2.13.2 Wreckage of Aircraft A

The upper part of the fuselage of Aircraft A was severely damaged, and both the wings and the tail were separated from the fuselage. Aircraft A was crushed by pressure from the upper rear part and was found lying on the runway 90 m from the point of the collision (see Figure 30-1). Aircraft A was also burned by fire except for the lower part of the fuselage and parts that were blown off.

(1) Fuselage

The fuselage was crushed by pressure from the upper rear, and the upper surface, including the wing structure, was completely damaged and disintegrated, and part of the tail fuselage was separated, along with the horizontal and vertical stabilizers and scattered forward and around. There was also fire damage throughout the fuselage (see Figure 30-2).

Figure 30-1: Image of aircraft damage

Figure 30-2 Fuselage of aircraft A (right side)

(2) Tail

The tail, which was separated from the tail access door on the underside of the fuselage as a result of the collision, along with the vertical and horizontal stabilizers, and was found in several pieces that were heavily damaged and broken. Part of the rudder was found compressed and buckled from the rear and was found inside the nose structure of Aircraft B.

The main structure of the vertical stabilizer was found close to Aircraft B (see Figures 31-1 and 31-2).

Figure 31-1 Aircraft A Vertical Stabilizer

Figure 31-2 Aircraft A Vertical Stabilizer(details)

(3) Wings

The left wing broke off near the base of the fuselage and was bent 90 degrees forward along with the engine. The center and right main wings were separated from the fuselage and scattered about 50 m forward in an inverted state. The trailing edges of both wings had been severely buckled and deformed by pressure from behind, and most of the outer parts of the wings from the engines were broken. They had also sustained significant damage from the fire that broke out after the collision (see Figure 32).

Parts of the shattered wing structure of Aircraft A were found in the downstream fan blades of both engines of Aircraft B.

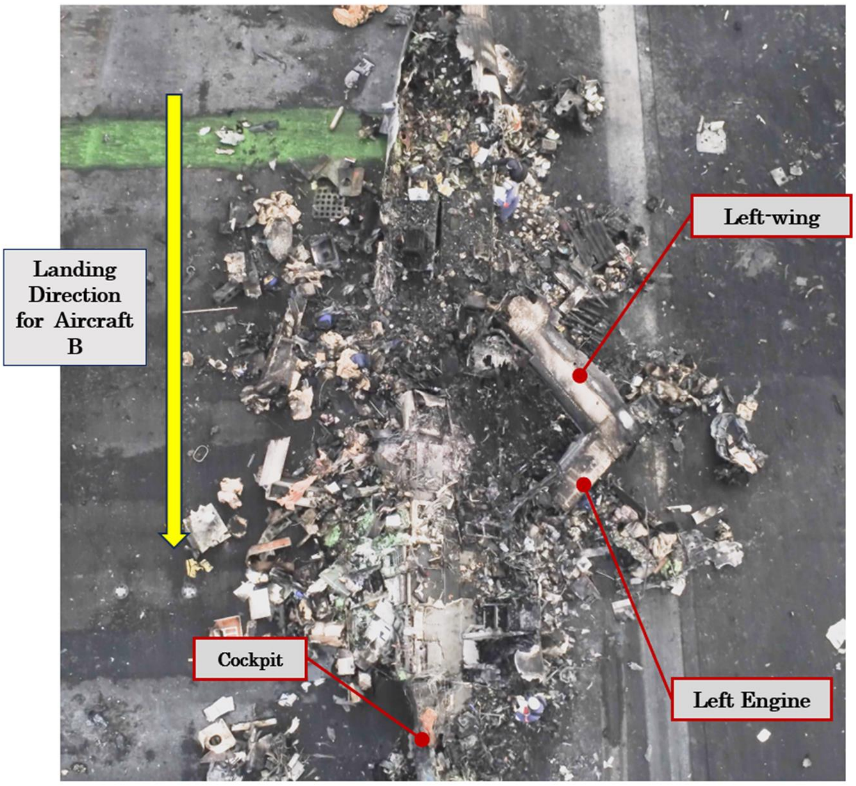

Figure 32: Condition of the Left Wing and Left Engine of Aircraft A

(4) Engines

The left engine was found attached to the left wing along with the propeller and the reduction gear box (hereinafter referred to as RGB) that drives it, but it was severely damaged, with one propeller blade flying off and the remaining three severely damaged and deformed. The right engine had fallen out of the nacelle and was found about 400 m from the wreckage of Aircraft A. All of the propeller blades had flown off, and the RGB, including the propeller hub, had fallen into the grassy area next to the runway near the engine. Both were severely damaged and had been damaged by the fire.

2.13.3 Wreckage of Aircraft B

Aircraft B' was sitting in a forward-leaning position with its's nose landing gear buried in the grassy area beside the runway, The radome, forward bulkhead, and intakes of both engines had damaged caused by the collision with Aircraft A.

In addition, a fire broke out, which destroyed most of Aircraft B, except for part of the nose, both wings, both main landing gears, the lower fuselage, and part of the tail of the fuselage (see Figure 33).

Figure 33: Overall View of Aircraft B

Most of the main structural components of the aircraft were made of CFRP, but most of them were burned, exposing the bundles of tape like carbon fiber tapes that make up the inside of the CFRP interior, which were burned, and had lost their strength.

In addition, large amounts of resin ash and fiber dust were flying around the site every time the wreckage was moved (see Figures 34-1 and 34-2).

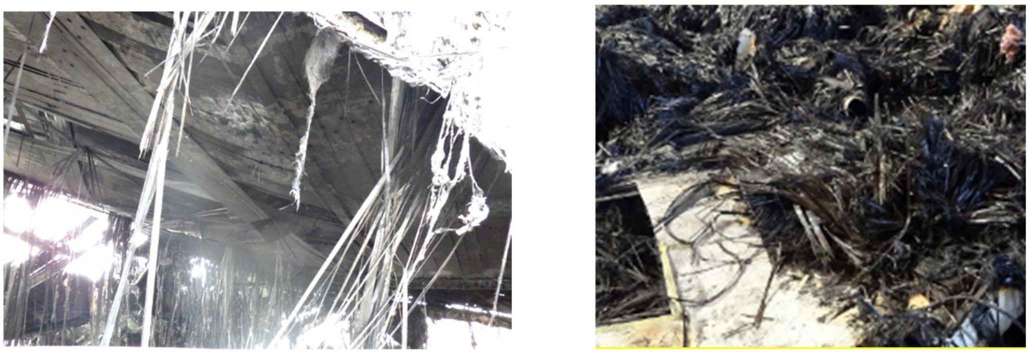

Figure 34-1: Burnout of the CFRP of Aircraft B
(Left: underside of the right main wing, Right: fuselage)

Figure 34-2 Dust after CFRP Burnout

(1) Fuselage

The fuselage was destroyed by fire, leaving only the nose, center wing, and part of the rear underside of the fuselage (see Figure 33).

a Nose

The nose was burned, except for the windshield frame and its surroundings, and the forward frame. The radome was completely destroyed except for the framework, and the inner frames (hereinafter referred to as "FR0" or "FR1, with frame numbers), of which FR 0 in the forwardmost part was cracked vertically in the center (see Figure 34-3). Inside, part of the crushed rudder (140 cm x 115 cm) (see Figure 34-4) of Aircraft A was embedded, as it penetrated FR1, the pressure bulkhead behind it, and its front protective shield (made of aluminum alloy) (See Figures 34-3, 34-5, and 34-6). In addition, on the extension line, a horizontal crack had appeared in FR0 slightly above the center, and part of Aircraft A's left elevator had pierced the left nose skin FR1 (see Figures 34-3 and 34-4).

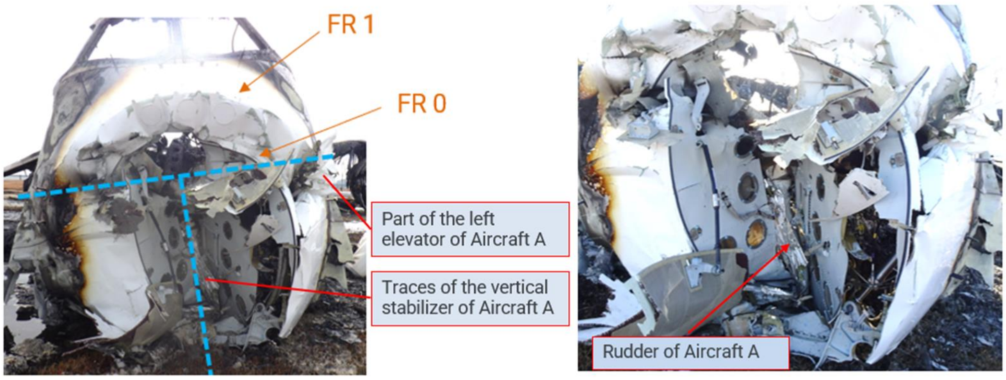

Figure 34-3 Nose Section of Aircraft B (external)

Figure 34-4 Rudder and Elevator of Aircraft A

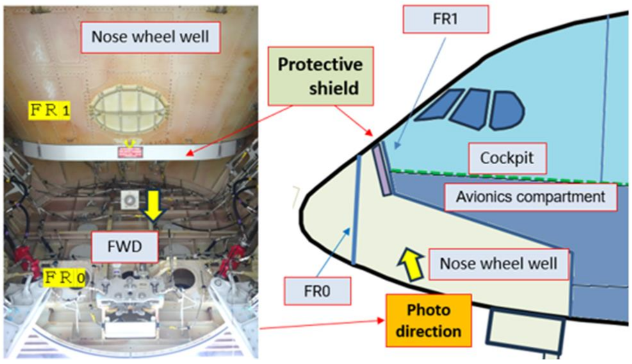

Figure 34-5 Protective Shield of Aircraft B

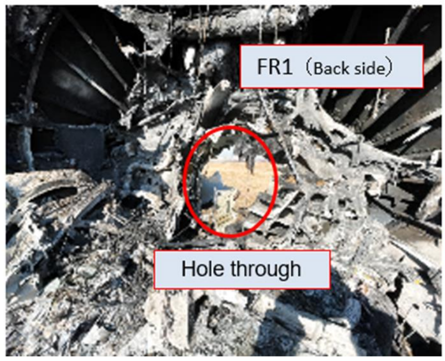

Figure 34-6 Nose Section of Aircraft B (inside)

The cockpit and its floor had been burned, but some of the structural components around the nose landing gear below had retained their original shape. The nose landing gear had broken off at the base of the shock strut piston, and the lower parts, including the tires, had fallen off near the point of impact. The upper part had not collapsed, but was buried in the grass in a down-locked position.

b Other

Most of the forward fuselage, excluding the nose, was burned, with the underside touching the grass. The upper part of the center of the fuselage was burned, but the wing structure and both main landing gears had retained their original shape. After being exposed to fire for a long time, the rear fuselage collapsed to the ground, most of it burned out, leaving only a portion of the underside of the fuselage.

(2) Wings:

Both wings were exposed to fires that broke out in the engines and fuselage due to the impact, and the surrounding areas were burned.

a Left Wing

The left wing maintained its shape, but the area from the left engine attachment point to the fuselage side had been burned by fire, and the leading edge had been burned off by fire. As for the trailing edge, the outer track fairing of the inner trailing edge flap had fallen off, and there were signs of liquid leaking from near the base. At the time of landing, the aircraft had been carrying approximately 7,000 lb (approximately 3,900 L) of fuel, but when the aircraft was dismantled, very little fuel remained inside the wings (see Figure 35).

Figure 35: Condition of the Main Wing (from rear)

b Right Wing

The right wing was exposed to a fire caused by the No. 2 engine due to the collision, and in particular the underside of the fuselage from the right engine attachment point was burned. The wing was bent around ribs 10 and 11, and the wing tip was touching the ground.

The leading edge between the engine and the fuselage was burned away, and the trailing edge flap was damaged and had fallen off and burned away. Almost none of the 7,350 lb (4,100 L) of fuel remained, but some had accumulated on the lower wing tip side (see Figure 35).

(3) Engines

a Left Engine

There were impact marks at the 2 o'clock and 10 o'clock directions toward the front of the intake, and the intake barrel at 2 o'clock (fuselage side) was torn and had a hole. The right side (fuselage side) of the fan cowl was largely damaged, and fragments were scattered on the runway. (see Figure 36-1) Inside the damaged right cowling, the one of the two suction lines to the engine-driven pump of the hydraulic system had been ruptured by the collision, and numerous other damages were found. The thrust reverser was in the stowed position, but its locked position status is unknown because it cannot be structurally determined from the outside.

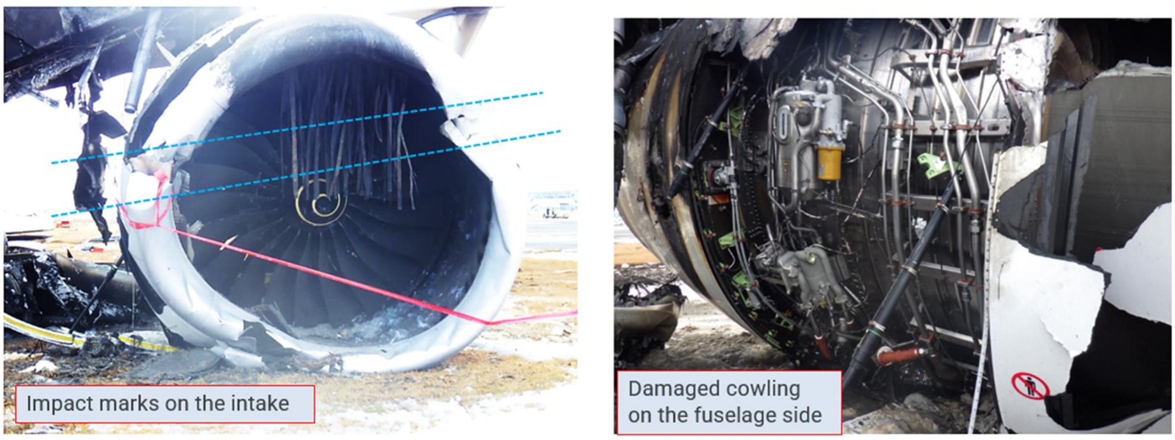

Figure 36-1 Damage to the Left Engine

Seven of the 22 fan blades in total had large tip damages, and a number of other blades were also damaged. Part of the shattered wing structure of Aircraft A was also found on the downstream the fan blades (see Figure 36-2). The rear of the fan duct was exposed to intense fire, and the inside of the duct was also severely damaged by fire.

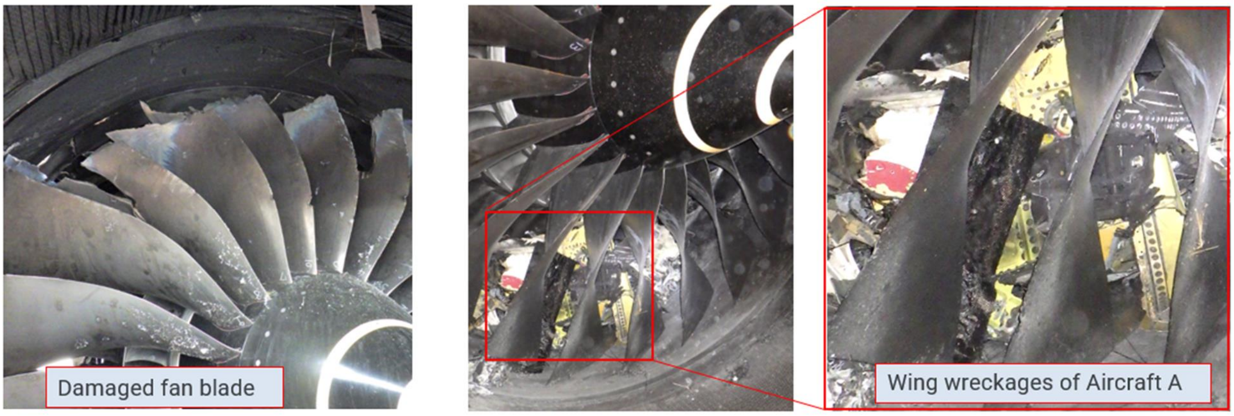

Figure 36-2 Wreckage of Aircraft A Found inside the Left Engine

b Right Engine:

Overall the damage from the fire was severe, and the intake was completely destroyed. The fan section was deformed and sunk into the ground, and several fan blades had lost their tips and were deformed along with the fan case. The spinner was also damaged by the fire. In the downstream a blade, there was part of Aircraft A's main wing, which had been shattered, as was the left engine. The entire engine sustained significant damage from the fire, and both the fan cowl and the reverse cowl were severely burned, and other equipment in the vicinity, such as EEC was also completely destroyed by the fire. (See Figure 37)

Figure 37 Damage to the Right Engine

(4) Both Main Landing Gears

Both main landing gears were attached to the aircraft normally. There were no abnormalities in the main structure, but there were numerous instances of damage, such as broken hydraulic pipes, in the surrounding area. All the tires, except tires No 1 and No6, had burst as a result of damage caused by the collision and the fire (see Figure 38-1).

In addition, part of the rear pressure bulkhead of Aircraft A was caught in the lock link of the left main landing gear strut (see Figure 38-2).

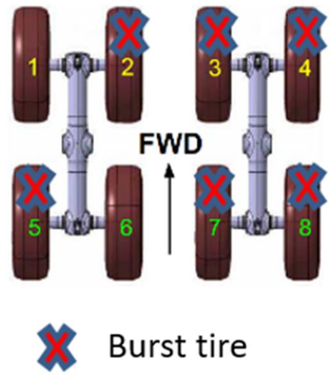

Figure 38-1 Landing Gear Tire Arrangement of Aircraft B

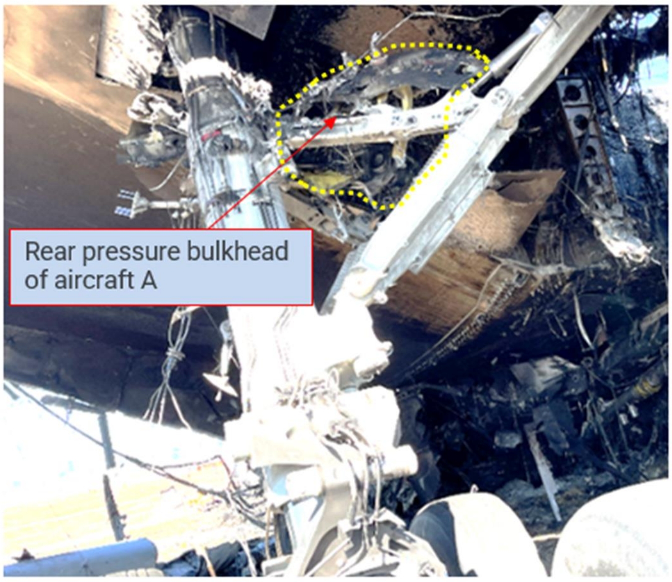

Figure 38-2 Left Main Landing Gear of Aircraft B (from rear)

(5) Tail:

The left and right horizontal stabilizers were not significantly damaged and retained their shape. The fuselage was damaged by fire, and the vertical stabilizer was also not significantly damaged, but it had broken off at the base and had fallen to the left. The APU air intake was closed and there were no signs of fire.

2.14 Information on the Collision Situation of Aircraft A and Aircraft B

2.14.1 Attitude in the Event of the Collision

Based on the airport surveillance camera footage and the impact marks of Aircraft B, it is estimated that Aircraft A was stopped with its nose pointing in the same direction as the magnetic heading of the runway when it collided with Aircraft B. From the FDR records of Aircraft B, the pitch angle of Aircraft B was 3.5° up and its heading was 337° (magnetic heading) when it collided with Aircraft A.

From the above, it is most likely that the relative positions of the two colliding aircraft were as shown in Figure 39.

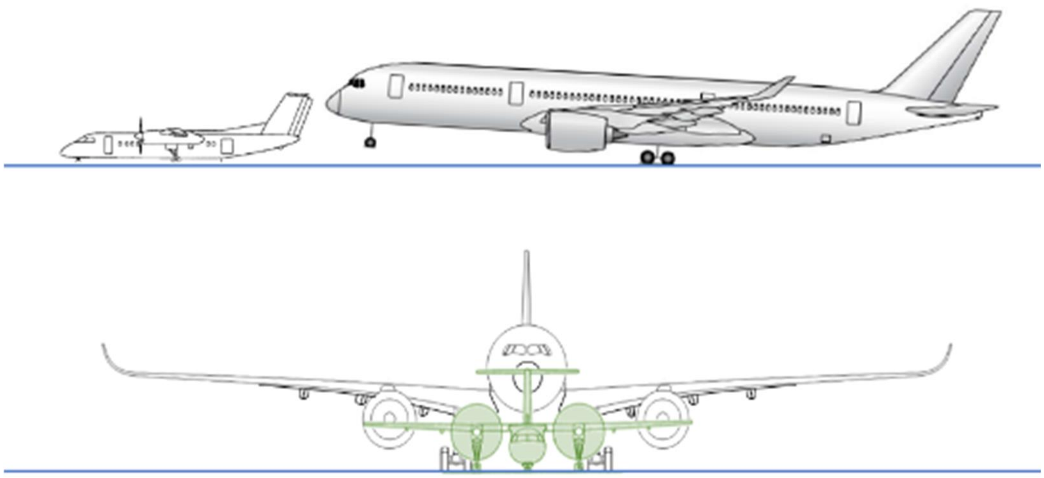

Figure 39: The Situation just before the Collision between Aircraft A and B
(provided by Airbus and de Havilland)

2.14.2 Information on Damage to the Aircraft after the Collision

Based on the airport surveillance camera footage, footage provided by passengers of Aircraft B and witnesses, the FDR and CVR records of both aircraft, the condition of the wreckage, and the statements of the crew and passengers of Aircraft B, it is determined that the damage to the aircraft after the collision was as follows.

After Aircraft B collided with the tail of Aircraft A with its nose up, it climbed over Aircraft A and passed Aircraft A in that state. A large fire broke out in the area around the collision point, likely caused by flames believed to have been generated by the dispersed fuel from the damaged Aircraft A.

2.14.3 Damage to Aircraft A

Aircraft A's upper fuselage was severely damaged, and both the wings and the tail were separated from the fuselage. It was crushed by pressure from above and behind and came to rest on the runway about 90 m from the impact point. A large number of parts of Aircraft A, mainly the remains of the fuselage, were scattered on the runway from the impact point, and the right engine and surrounding parts had fallen on the runway about 400 m from the impact point.

Aircraft A's FDR and CVR stopped recording immediately after the collision. The nose of

2.14.4 Damage to Aircraft B

The nose of Aircraft B first collided with the tail of Aircraft A, causing extensive damage to the front part of the avionics compartment under the cockpit floor. Both engines of Aircraft B then collided with the main wings of Aircraft A, causing major damage. The fuselage of Aircraft A, which had collided, also damaged the underside of Aircraft B as Aircraft B climbed over and passed Aircraft A. Aircraft B continued to travel for about 1,400 m, then veered off the runway to the right, continued for about 300 m through grassy area next to runway, and collided with ground facilities, sustaining further damage. It then came to a halt with its nose landing gear buried in the ground and tilted forward.

As rolling the runway, the Aircraft B did not roll over or change course significantly, likely because the main landing gears did not collapse and there was no asymmetric drag from flight controls, reverse thrust, or brakes as they became inoperative.

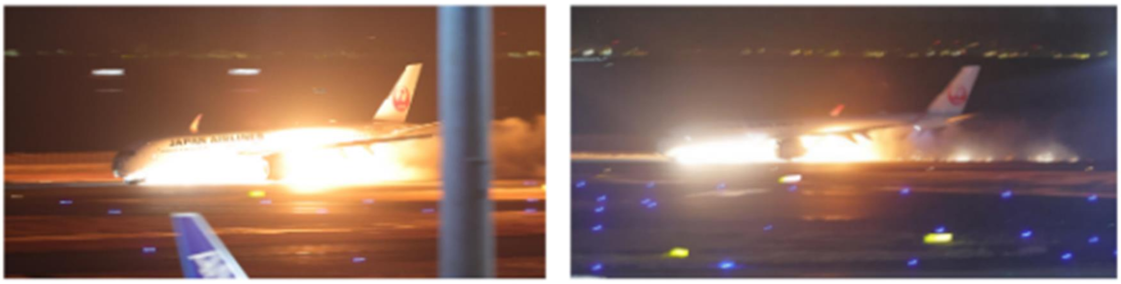

Figure 40-1: Aircraft B Rolling after the Collision.
(provided by an eyewitness)

2.14.4.1 Operational Status of Aircraft B's FDR and CVR after the Collision

Aircraft B's FDR stopped recording approximately 1.9 seconds after the collision. The FDR recorded that the output of the 115V AC EMER BUS1, which supplies power to the FDR, was lost 0.8 seconds after the collision, and it is most likely that the FDR stopped operating due to a loss of power or damage to the wiring.

The CVR continued to operate even after the FDR had stopped recording, and stopped 5 seconds after the aircraft stopped off the runway. it is more likely that power was lost to the 28V DC EMER BUS2 which supplies power to the CVR, or the EPDC or surrounding wiring was damaged, as a result of the impact when Aircraft B veered off the runway and stopped (See Figure 40-2) .

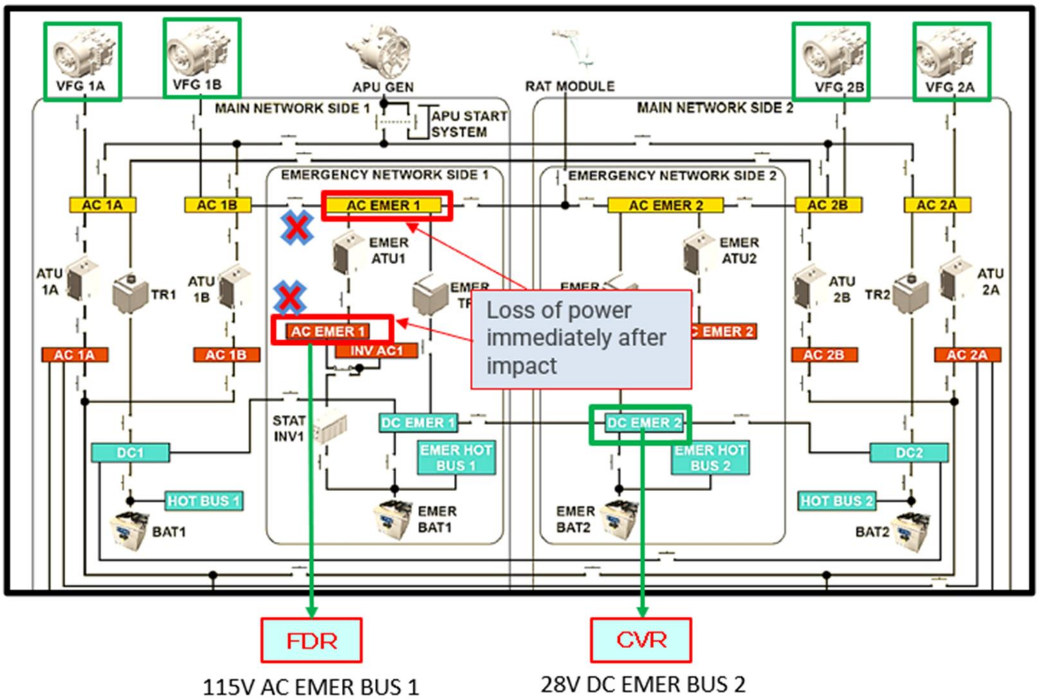

Figure 40-2 BUS related to FDR and CVR
(additions to the figure provided by Airbus)

2.14.4.2 Situation from the Collision to Aircraft B to a Halt

(1). Damage to the Nose

The tip of the radome of Aircraft B collided with the T-shaped tail of Aircraft A from the front center. Part of Aircraft A's rudder was crushed and penetrated the forward bulkhead of Aircraft B, however, there was no major damage to the cockpit or passenger cabin of Aircraft B. This is possible because the floor structure of the passenger cabin of Aircraft B supported the fuselage structure due to its attitude at the time of the collision and its relative position to Aircraft A, allowing the nose to retain its shape without being crushed.

On the cockpit, the cockpit door was separated from its frame by the collision, while the front of the avionics compartment under the cockpit floor was also damaged by the collision. It is believed that serious damage was caused to the following mechanisms (see Figure 40-4 and Figure 40-5):

- Rudder pedal position sensor and its input mechanism
- Brake pedal position sensor (BPTU) and its input mechanism
- Electrical wiring consolidation point (terminal module) behind the central panel of the cockpit
- Surrounding circuit breaker panels and EPDC (Electric Power Distribution Center), surrounding electrical wiring, and others.

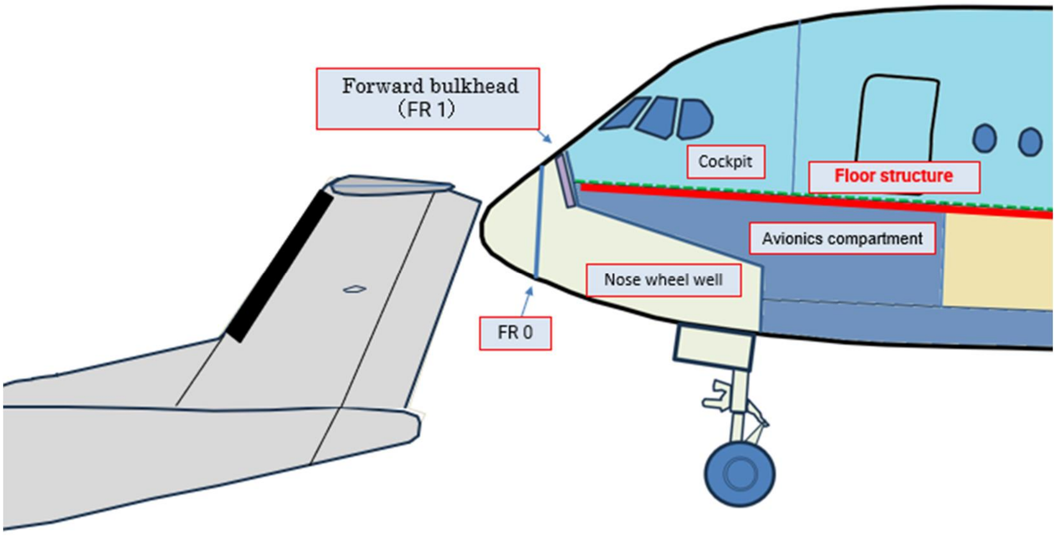

Figure 40-3 Estimated Relative Position at the Time of Collision

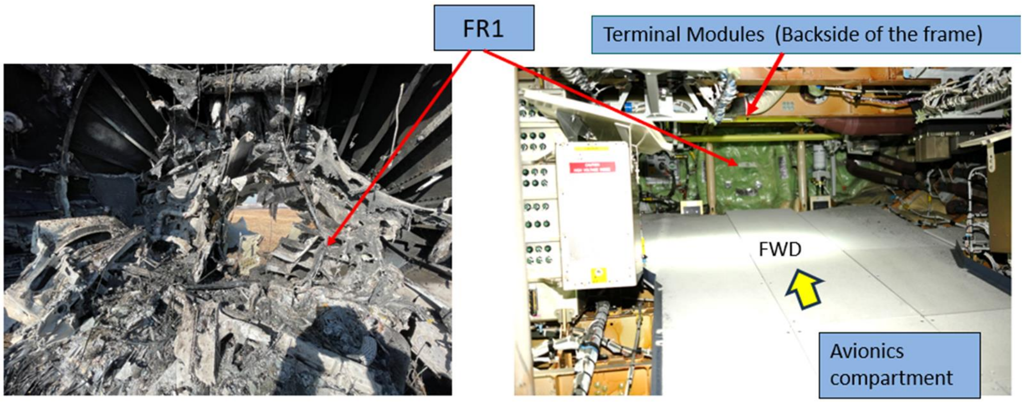

Figure 40-4 Damage to the Nose

+

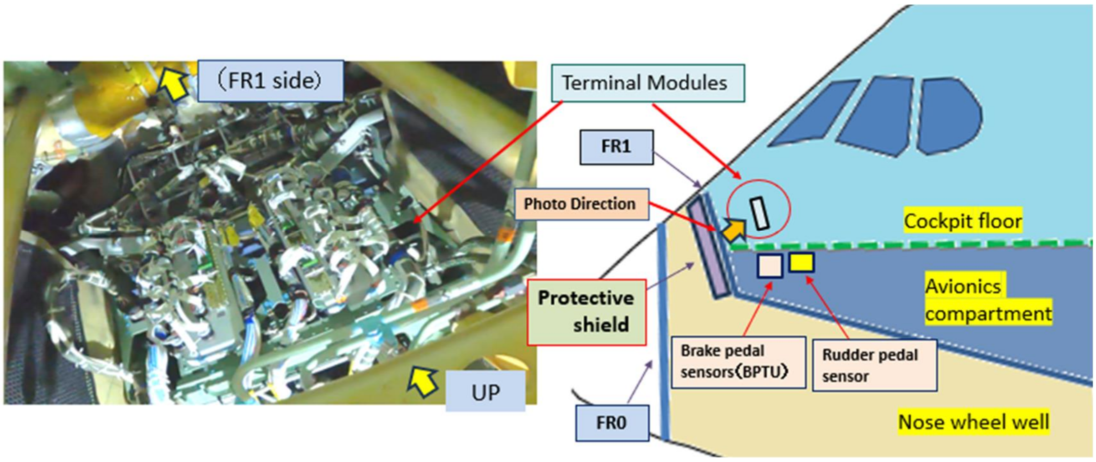

Figure 40-5 Terminal Module & Location of Damaged Equipment

The nose landing gear broke off in the middle of the strut and separated from the aircraft. The separated parts, including the nose tire, fell onto the runway 480 m from the impact point. The struts remaining in the aircraft did not collapse, so the underside of the nose fuselage avoided contact with the ground during the roll (see Figure 40-6).

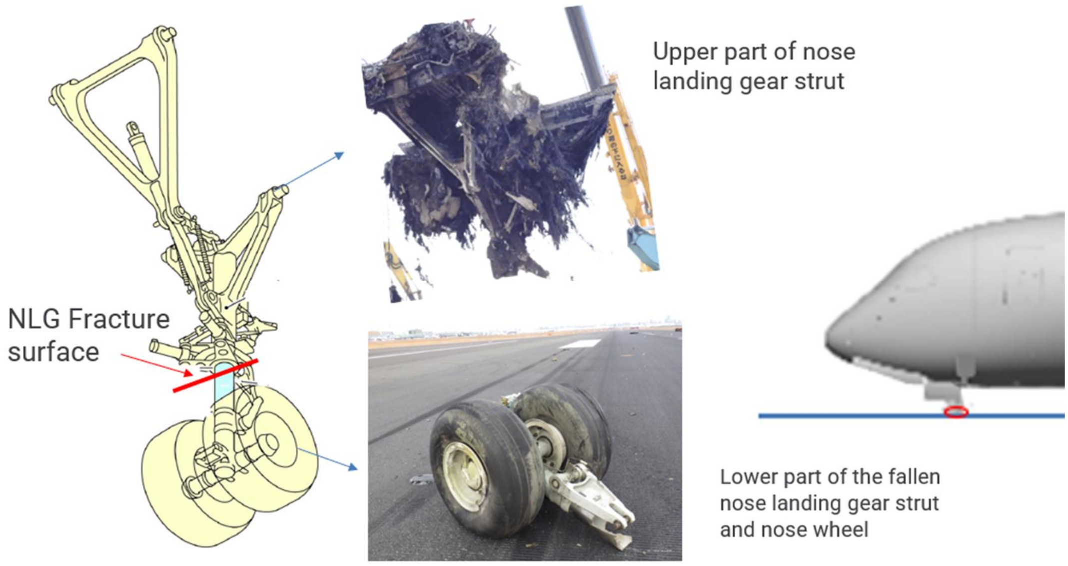

Figure 40-6: Broken Nose Gear (added to the diagram provided by Airbus)

(2). Damage to the Lower Fuselage:

The fuselage of Aircraft A, which collided with Aircraft B, caused damage to the lower fuselage of Aircraft B when Aircraft B climbed over and it passed Aircraft A. Most of the air conditioning-related equipment inside the wing belly fairing was broken and detached by the impact from below, and an intense fire (could be categorized as an explosion) broke out from aircraft A, causing the left main landing gear well door and left main landing gear door to fall off. These were found in a severely burned condition near the point of impact. (See Figure 41-1 and Figure 41-2).

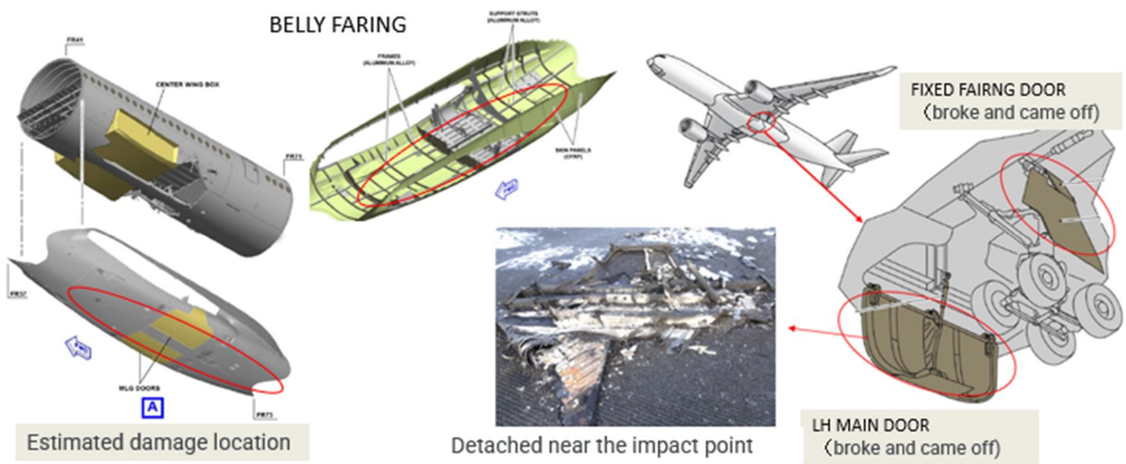

Figure 41-1 Damage to Lower Fuselage, Belly Fairing
(additions to the diagram provided by Airbus)

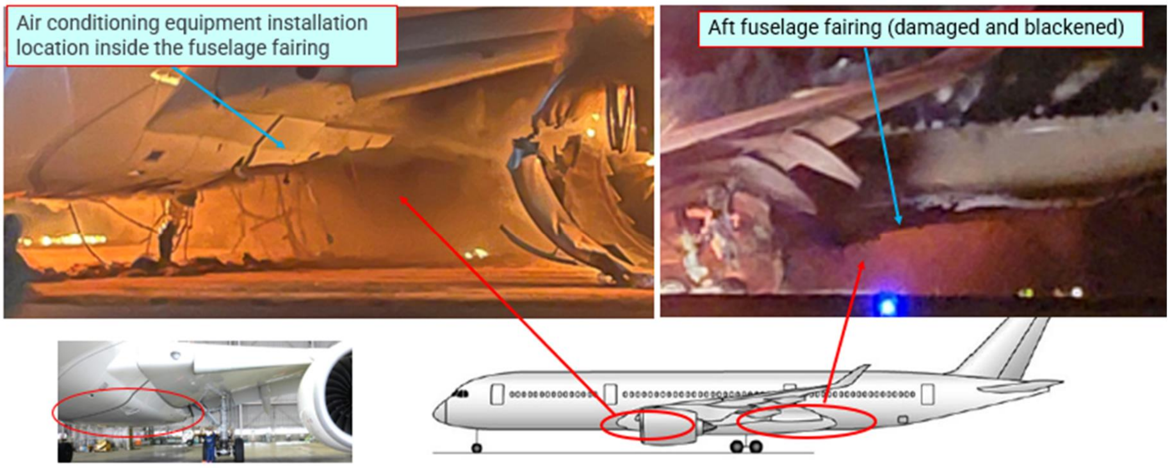

Figure 41-2 Damage under the Fuselage
(Diagram provided by Airbus, pictures provided by passenger)

The landing gear well was left open by the falling door, and it is believed that this area was set on fire by debris and fuel from aircraft A which had ignited at the time of the collision. A burning smell coming from the cabin near the front of L3, which was almost directly over the landing gear well, and smoke was seen coming from under the floor immediately after the aircraft came to a halt. The fuselage behind the landing gear well was also damaged, with the underside turning black (see Figure 41-2).

(3) . Electrical Power Generating System and Power Distribution System

The FDR recorded that 0.8 second after the impact, 230V EMER AC BUS1 and 115V EMER AC BUS1 were lost. In addition, images taken from outside Aircraft B- and from inside the cabin showed that the power feeder lines and wiring of the two generators (VFGs) on the right engine had been damaged (see Figure 43).

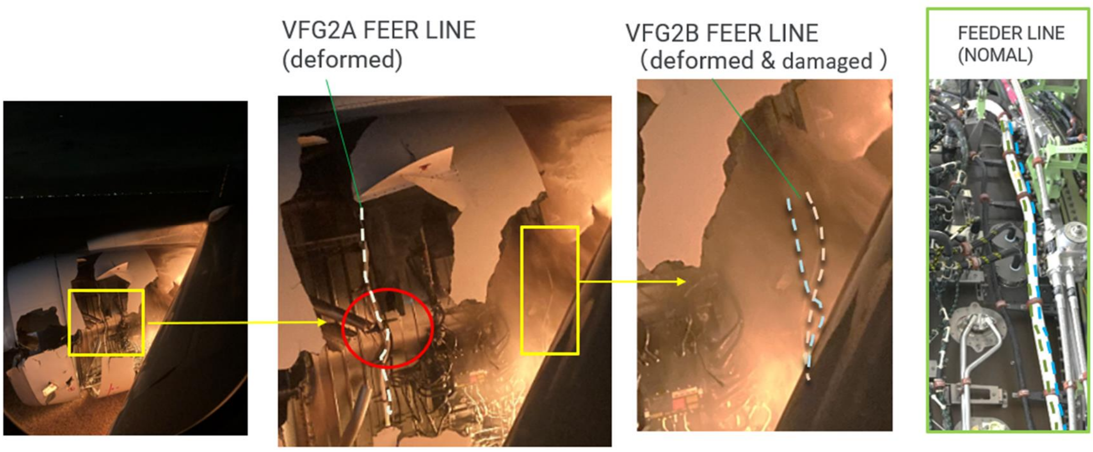

Figure 43 Damage to the Right Engine Power Feeder Line
(pictures provided by passenger)

Immediately after the collision, the emergency lights were on inside and outside Aircraft B. The emergency lights were on, indicating that either the 115V AC NML BUS, the 28V DC NML BUS, or the 28V DC EMER BUS had lost power. The exterior lights (SYS1: powered by 115V AC NML BUS1) also went out, but the red anti-collision lights and strobe lights (powered by 115V AC ETOPS BUS 1 and 2) continued to operate until Aircraft B came to a stop. During the roll after the collision, the in-flight service equipment and cabin lights (powered by 115V AC NML BUS) went out in the cabin, and when Aircraft B deviated from the runway, the chime on the cabin speaker (powered by 28V DC EMER/NML BUS) stopped midway.

In addition, the non-volatile memory (Non-Volatile Memory, hereinafter referred to as "NVM") of the left engine's EEC contained records after the FDR had stopped, The NVM in the EEC does not provide a constant recording of engine parameters, however it does record data from a single point in time when an engine fault is identified within the EEC. The following records were found here that are thought to be related to the power supply:

17:47:25 Engine stall was detected
(It is most likely due to a collision with the engine).

17:47:26 No power was supplied to ignition A.

17:47:28 Backup power from the aircraft to the EEC was lost on both channels (hereinafter referred to as “CH”) A and B.

17:47:33 No power was supplied to ignition A or B.

It has been confirmed that the time recorded in the EEC has a system time lag and differs from the actual time recorded by the FDR used as the time reference.

From the above records, it is most likely that the following BUS power sources were lost:

:

- 115V AC INV BUS	Ignition A
	EEC backup power CH A, and others.
- 115V AC NML BUS 1B	Ignition B (normal)
	EEC backup power CH B, and others.

Regarding the two generators installed on each engine, the two on the left engine had stopped generating power after the collision because the left engine's RPMs had dropped. As for the right engine, it is more likely that at least one of them was generating power, as the AC-powered anti-collision lights and others were on during the roll.

Just before the Aircraft B came to a halt, the generator on the right engine was shut sown, leaving only battery to supply power to the emergency power system, but the impact of collapsing and stopping is believed to have further damaged the avionics compartment. And after Aircraft B came to a stop, most of the system in the emergency power system did not work, with the exception of some parts such as the cockpit display. From this, it is believed that most of the 28V DC EMER BUS has been damaged and is no longer usable.

(4). Flight Control System

The flight crew continued to fully depressed the directional rudder pedal to correct course during the roll, but the aircraft did not respond and the video footage collected showed no indication of the rudder movement.

The FDR recorded abnormal values indicating the rudder pedal position readings (-5° → +64° → -11° in 0.2 seconds) 0.5 seconds after the collision. The rudder pedal position sensor and other components were severely damaged by the collision, and it is more likely that the flight crew's control was not transmitted correctly.

It was also recorded that three PRIMs were out of control 1.1 seconds after the collision. As the position information of each control surface recorded in the FDR was valid, it is most likely that control of each control surface was transferred to the SEC.

The flight crew also tried to operate the steering tiller because the rudder was not working, but this was also ineffective. It is believed that this was because the nose landing gear broke off in mid-swing due to the collision, resulting in the loss of the nose wheel steering capability.

In addition, the flight crew fully extended the speed brake lever during the roll as they felt there was no sign of deceleration. The FDR recorded that after touchdown, the 14 spoilers*36 automatically rose as ground spoilers*, but on the way to the fully open position (100%), they were extended to about 80%, then retracted to about 60%, where the FDR recording stopped. After the collision, images taken from inside the Aircraft B during the roll shows that the seven spoilers on the right wing were extended, but not to the fully extended position, and each was extended unevenly. (see Figure 44).

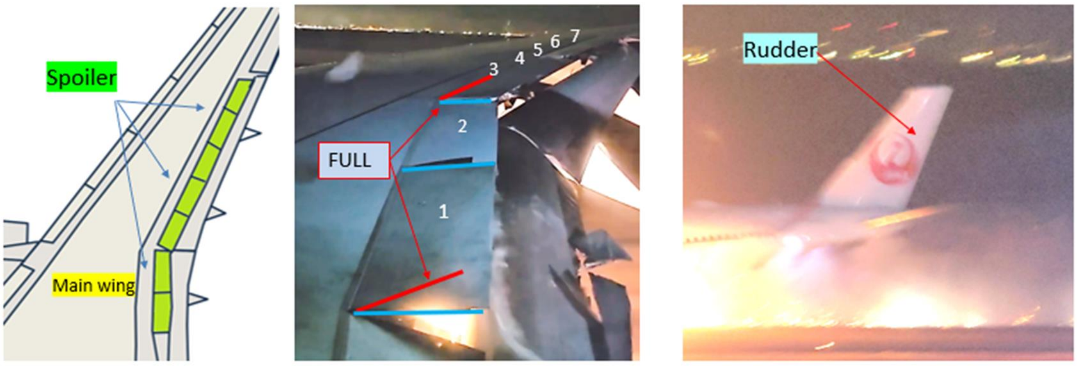

Figure 44: Condition of the Control Surface
(provided by passengers and witnesses)

(5) Brake System

The flight crew had used the auto brake system at landing, with the brakes set to apply automatically after touchdown. However, the aircraft did not decelerate after the collision, so they applied the wheel brakes (pressing the brake pedals with both feet), but

*36 "spoiler" is a resistance plate on the upper surface of the main wing. When deployed, the spoiler increases the resistance of the main wing and is used to assist in deceleration and turning.

there was no sense of deceleration in response to the operation from either the left or right seat.

In the FDR recordings, after the collision, different values were recorded for the left and right seat inputs of the brake pedal, then the data became invalid and the recording stopped.

Both the left and right BPTUs were found under the cockpit floor during the wreckage search. Both the left and right seats had two rods transmitting the pedal input, but all four were broken (see Figures 45-1 and 45-2).

It is most likely that when the forward bulkhead (FR1) was destroyed by the collision, the BPTU operating mechanism was damaged, and the flight crew's manual brake pedals inputs were transmitted to the braking system. In addition, The brake hydraulic valves and piping at the front of both main landing gears had been damaged as result of the collision with Aircraft A, the main landing gear wells where the brake hydraulic system was located had been damaged, and most of the tires had burst, so it is possible that the brakes would not have operated normally even if the input mechanism had been normal.

FDR records show that the auto brake system was set by the flight crew before landing, but the system was disengaged after the collision. It is believed that the reason for this is that the PRIM, a prerequisite for the Auto Brake System to operate, was lost entirely due to the collision.

The CVR recorded a synthetic voice saying "auto brake off" three times after the collision, along with a loud scraping sound on the ground.

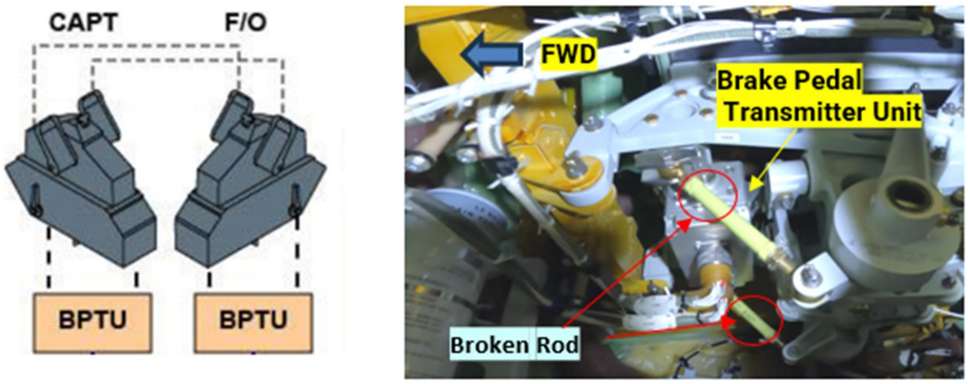

Figure 45-1 BPTU (Brake Pedal Transmitter Unit)
(additions to the diagram provided by Airbus)

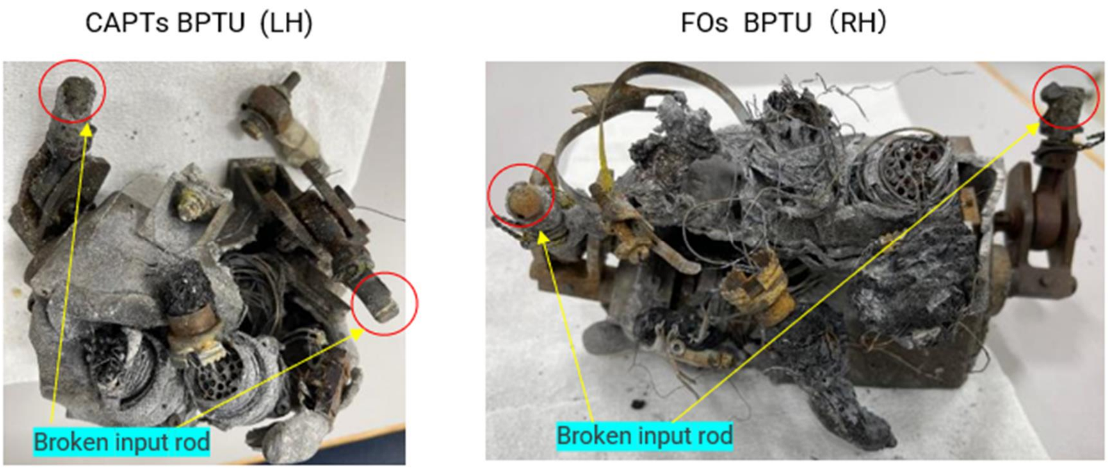

Figure 45-2 Damaged BPTU and Broken Input Rod

(6). Engines

After touchdown, the collision occurred almost simultaneously with the flight crew applying reverse thrust. Both left and right engines were at approach idle*37.

The left and right wings of Aircraft A collided with the air intakes of both engines of Aircraft B, then passed between the fuselage and the left and right engines of Aircraft B, and came into contact with the inner fan cowls of Aircraft B, damaging both inner fan cowl and their interiors.(see Figures 46-1 and 46-2). The damage to the right engine was particularly severe, and the wiring around the EEC, which is the core of the engine control system, was damaged (see Figure 46-1).

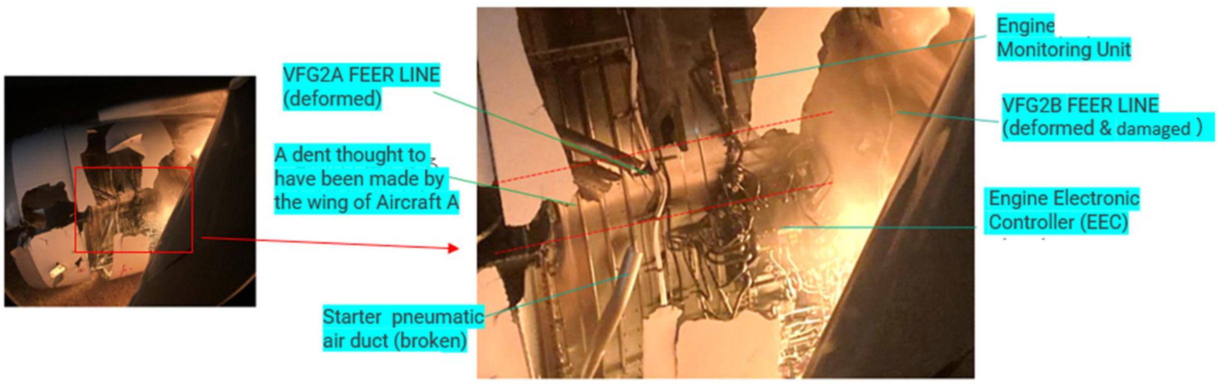

Figure 46-1: Right Engine Immediately after the Collision
(provided by passenger)

*37 "Approach idle" refers to the minimum thrust state of the engine in operating state selected during landing approach In order to ensure engine acceleration during a go-around, a higher engine rpm than ground idle is selected.

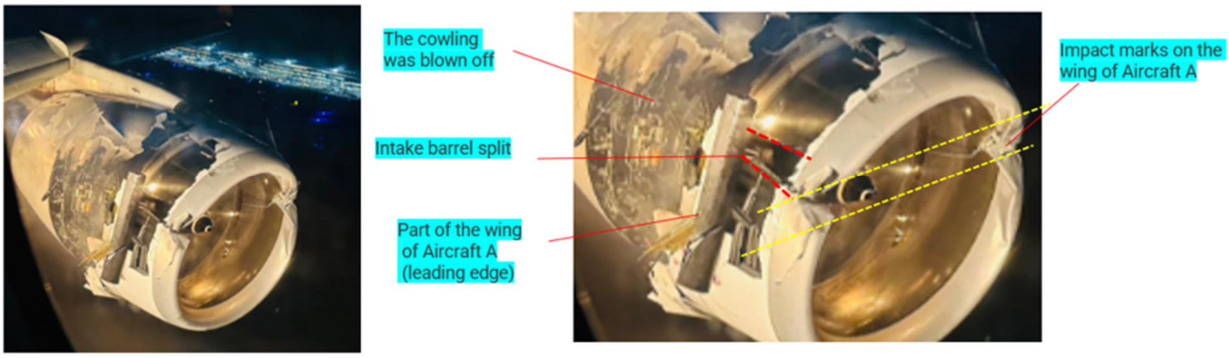

Figure 46-2 Left Engine Immediately after the Collision
(provided by passenger)

It is most likely that the main fuel tanks of the left and right main wings of Aircraft A contained approximately 1,600 liters of JET A-1 fuel respectively. And it is highly probable that the destroyed wing structure and scattered fuel were sucked into both engines of Aircraft B, causing damage to the fan blades, the engine interior and the inflow paths in the fan duct, and causing fires. (see Figure 46-3).

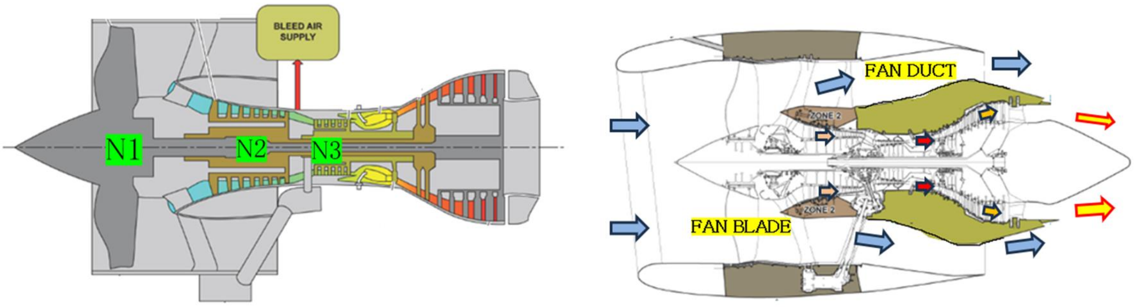

Figure 46-3 Engine Overview (RR TRENT XWB-75)
(Additions to the diagram provided by Airbus)

According to the FDR records, immediately after the collision, the data link between the aircraft and the right engine was lost, along with all primary data from the right engine. In addition, the records showed that the left engine's fan speed (hereafter referred to as "N1") dropped rapidly from 25.9% to 14.2%.

As for the thrust reversers, the thrust lever was set to the reverse thrust position almost simultaneously with the collision. As for the right engine thrust reverser, it is probable that the data link with the aircraft was lost before the EEC received a thrust reverse command, and it did not deploy. As for the left engine thrust reverser, the thrust reverser was unlocked and moved approximately 1% in the deployment direction, at which point the FDR recording stopped. As the thrust reversers were almost in the stowed position, there was no braking effect from reverse thrust.

Furthermore, although the FDR recording had stopped after the collision, the memory (NVM) of the left engine's EEC contained records up until the time the left engine stopped.

After the collision, the EEC detected that the engine had entered a compressor stall*38 and activated recovery mode. This involves significantly reducing the fuel flow rate to lower the combustion chamber pressure and reduce back pressure on the compressor in order to clear the airflow blockage in the engine caused by the stall, while at the same time activating the ignition, thereby preventing combustion chamber flameout*39. One second after the compressor stall was detected, the EEC recorded a fault indicating that the aircraft electrical system was not providing power to ignition A.

The left engine's ignition A receives power from the aircraft 115V INV BUS, but the upstream 115V EMER BUS1 lost power immediately after the collision. In this case, power is supplied from the emergency battery via an inverter, but it is believed that this also did not work due to damage caused by the first collision.

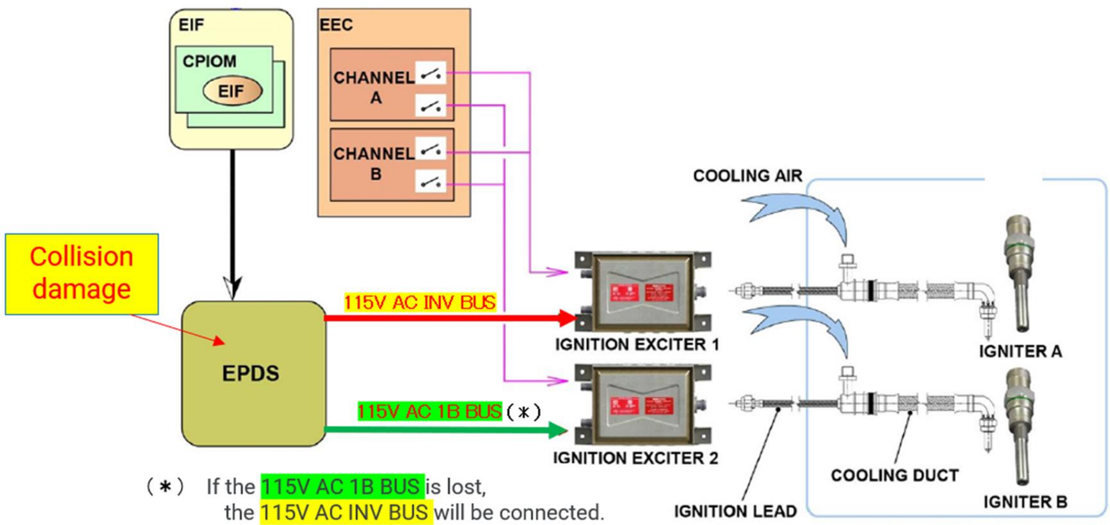

Figure 46-4 Engine Ignition System
(Additions to image provided by Airbus)

During this time, the RPM of the left engine continued to drop from ground idle (high pressure rotation system, hereinafter referred to as "N3", (N3　62%) and fell below the RPM at which the two generators (VFG1A, VFG1B) equipped on the left engine could generate electricity (N3 53%), and it is more likely that the two generators on the left engine stopped generating electricity 3 to 4 seconds after the collision.

*38 "Compressor stall" refers to the phenomenon that occurs when turbulence occurs in the airflow entering the engine, preventing the compressor from compressing the air normally, causing the airflow inside the engine to become blocked, resulting in abnormal noise and vibrations and unstable engine operation.

*39 "Flame out" refers to a loss of combustion in the engine's combustion chamber, causing the engine speed to drop and the engine to come to a standstill.

At this time, one generator (VFG2B) on the right engine had already stopped generating electricity, and as a result, it is most likely that three of the four generators on both engines had stopped generating electricity.

The aircraft's electrical power distribution system was designed to isolate and disconnect the 230V and 115V BUS on the other side to reduce the load on the remaining generator (VFG2A), and as a result, the normal bus on Side 1 was automatically disconnected.

Seven seconds after the first ignition command was issued, the EEC issued an ignition command again because the left engine rotation did not increase, However, ignition B, which was receiving power from the isolated 115V BUS on Side 1, did not operate, and ignition A, which was supposed to receive power from the emergency power source, also did not operate, so the left engine speed did not increase (see Figure 46-5).

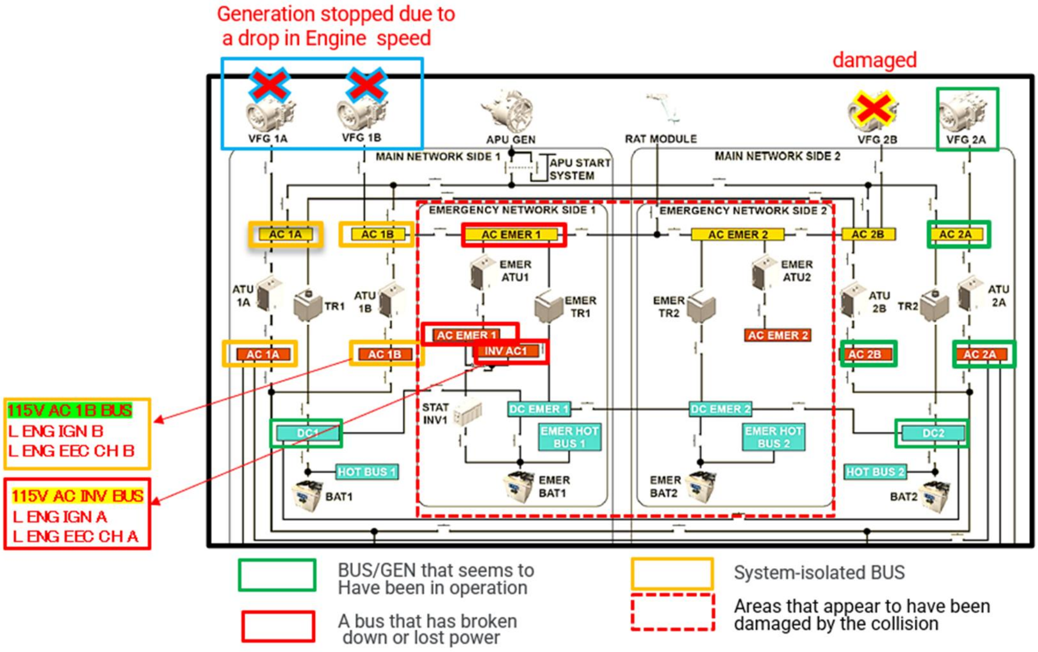

Figure 46-5 Power Distribution during the Roll
(image provided by Airbus with additional details)

The left engine was not able to maintain normal combustion and its revolutions dropped significantly, but the EEC continued to supply fuel in an attempt to keep the engine running. As a result, unburned fuel overflowed from the combustion chamber and caused a fire in the surrounding area.

Shortly after Aircraft B came to a halt, large flames broke out around the left engine, likely due in part to fuel that had been in Aircraft A's wing at the time of impact, and in part to unburned fuel that had exited the left engine's combustion chamber and ignited after hitting the ground. The fuel supply to the engine appears to have been stopped when the flight crew performed the engine shutdown procedure and closed the LPSOV.

(7). About the Cabin

Immediately after the collision, the lavatory door in front of the cockpit door came off its frame. In the forward galley, the electrical panel and decorative panels came off, causing some of the equipment to fall. In the cabin, several oxygen masks fell down near the center of cabin, some of the lights went out, and the emergency lights came on. The cabin crew member, sensing something was wrong, tried to talk to the other crew members over the intercom, but was unable to communicate over the intercom.

2.14.4.3 Situation after Aircraft Stop

After rolling the runway, the Aircraft B veered off the runway to the right and entered a grass area. As a result of sudden deceleration caused by entering the grass area and the collision with the Precision Approach Path Indicator (PAPI) on the Runway 16L and related ground facilities, Aircraft B suffered multiple impacts before coming to a stop. Aircraft B came to a stop in the grass area on the east side of the runway with the remaining upper part of the nose landing gear buried in the grass and the front of the fuselage in a tilted position. At this time, fires were still burning in both engines and the fuselage, and the fire in the left engine in particular was spreading to the ground surface and gradually growing. (See Figure 47)

Figure 47: Collapsed Aircraft B
(provided by a passenger)

(1). Electrical Power System

According to the statements of the flight crew members and video provided by passengers, the following events were confirmed to have occurred as result of the impact of the runway departure:

- The cabin lights went out, as did the exterior anti-collision lights. This was probably because the remaining generators that were still working had stopped, causing Aircraft B to lose all AC power.
- Several cabin crew members used the emergency call system, but the chime that was heard over the cabin speakers stopped as soon as the Aircraft B left the runway.

It is more likely that the reason for the failure of the last generator (VFG2A) operating on the right engine and the loss of all AC power was that the wiring related to the generator on the engine side or the avionics compartment side was severed or damaged by the impact. As a result of the complete loss of AC power, the two emergency batteries were left to supply power to the emergency power system.

After Aircraft B came to a halt, the following occurred:

- The CVR stopped recording about five seconds after Aircraft B came to a halt.
- The cockpit lights and control panel lights went out, and the displays and lights in the cockpit no longer responded to switch operations.
- All communication systems in the cockpit stopped working, making it impossible to contact air traffic control, and the cabin via the communication system including, the in-flight announcements.
- All lights in the cabin except for the emergency lights went out, and all in-flight announcements and intercom systems stopped working.

Most of the systems that stopped working were powered by the emergency 28V DC EMER BUS. Although most of the systems that received power from the BUS stopped working, some systems, such as the display at the front of the cockpit, were still working. This is probably because the BUS itself was still receiving power, but the wires from the BUS to each system were damaged, or the control side (EPDC) may have been damaged (see Figure 48).

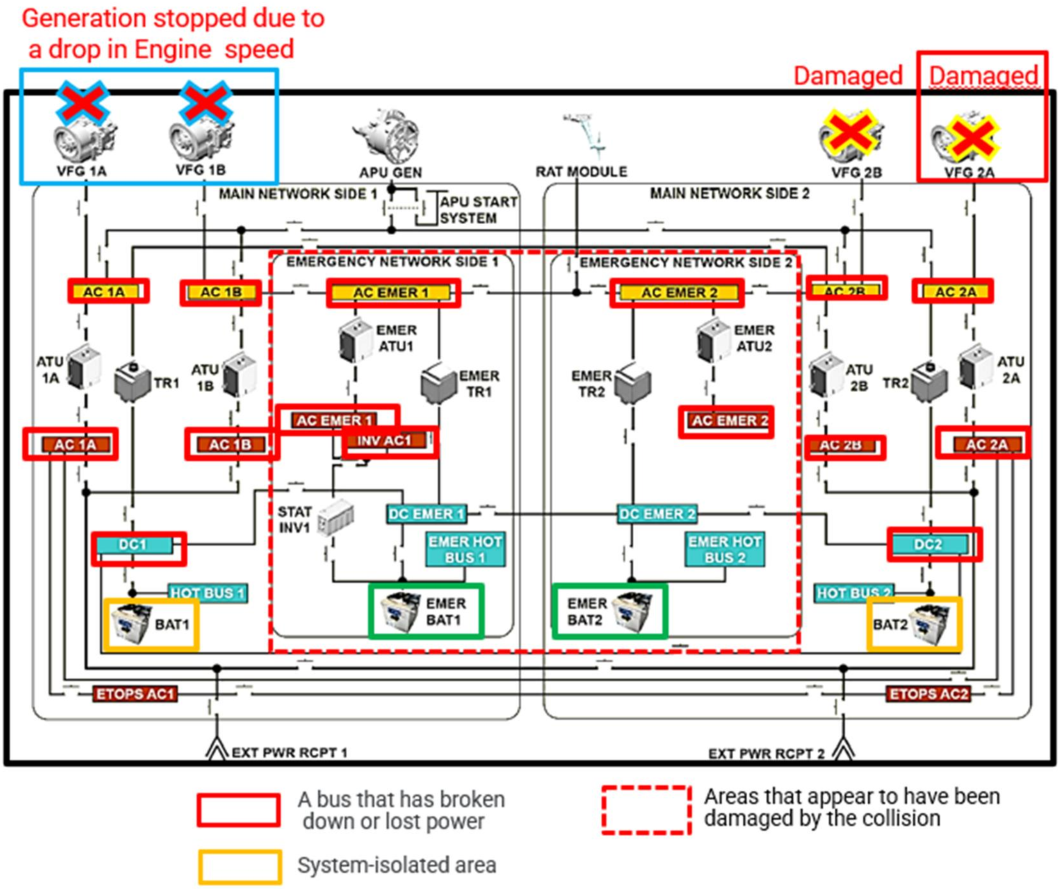

Figure 48: Power Distribution when Aircraft B came to a Stop.
(additions to the diagram provided by Airbus)

(2). Cockpit Condition

In the cockpit, all the lights went out. The multiple displays in front of the cockpit continued to display information, and numerous warning messages were displayed on the ECAM. The flight crew members immediately decided to evacuate and performed the checklist, but most of the switches in the cockpit did not respond when they operated them. As for the communications system, all power to the operation panels was cut off, making radio communication and calls to the cabin impossible, and it was not possible to communicate with air traffic control or make announcements to the cabin. The flight crew members operated the engine master switch to shut down the engines and operated all the fire switches and extinguishing agent release switches, but none of the lights indicating the results were lit, and the EVAC CMD did not operate. It is probable that this was due to an abnormality or damage in the system that had cut off the data link between the operation panels and the system, and an abnormality in the power sources, including the emergency power source.

(3). Status of the Cabin

Immediately after the collision, the cabin crew member who sensed the abnormal situation made emergency calls from their designated positions using each handset. At this time, the chime sounded multiple times, but was cut off midway when Aircraft B deviated from the runway. An attempt was also made to communicate via intercom, but was unsuccessful. Most probably due to partial loss of power and/or wiring problems, the CIDS stopped functioning when the aircraft stopped. As a result, all functions, including the intercom, in-flight announcements, and EVAC-CMD, were inoperable.

The impact of Aircraft B stopping was large at the front of the cabin where the nose landing gear had broken, but there was almost no damage to the cabin due to the impact when Aircraft B stopped. Immediately after Aircraft B stopped, all cabin lights were turned off and the emergency lights were on. Immediately after the aircraft came to a halt, smoke, and the smell of burning plastic began to come from between the wall and the underfloor near the front of L3, and the smoke gradually became thicker around the L3 door area.

(4). Engine Condition

After Aircraft B stopped, the flames around the left engine gradually grew larger, and the flames spread widely to the engine itself and the surrounding ground (the grass area beside the runway) (see Figure 49-1). After Aircraft B stopped, the fire was contained by water sprayed by fire engines that arrived at the scene, but the Fires continued inside and outside the engine and in the lower fuselage. The flames in the lower fuselage then spread to the passenger cabin, resulting in the aircraft being completely burned.

Figure 49-1: Engine Condition after Landing
(provided by passengers)

In addition, a hole was opened through the fan case at the 9 o'clock position of the right engine body, and flames continued to spew from it. It is probable that this flame is believed to have been caused by a fire that was started by fuel leaking from the damaged area and high-temperature, high-pressure compressed air when the fuel pipe connected to the combustion chamber directly above the duct was damaged after the duct for the high-pressure turbine cooling air of the engine was ruptured by the collision (see Figure 49-2).

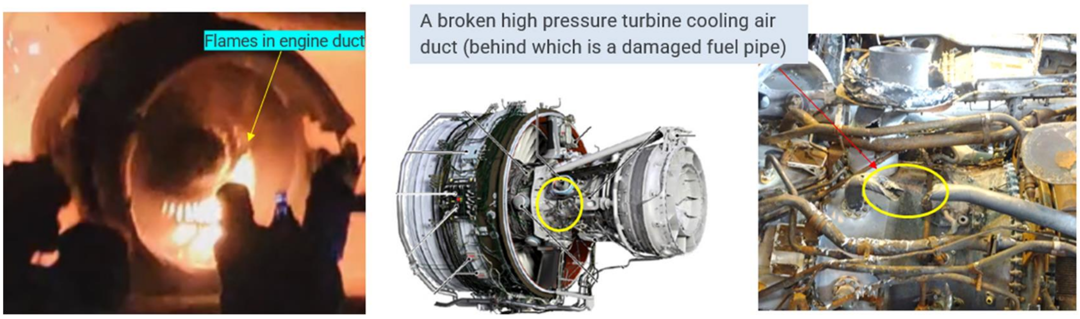

Figure 49-2： Damage to the Right Engine at 9 o'clock
(added to Airbus diagram)

Following the checklist shutdown procedure, the left engine master switch was turned "off," which caused the engine to shut down. The EEC's NVM recorded a malfunction message "HMU SOV STUCK" (information that the HPSOV was closed without an order to shut down the engine), and it is believed that the engine shut down due to the HPSOV being closed unintentionally.

Based on the damage around FR1 in the nose of the aircraft, it is possible that the HPSOV closed due to an engine flameout without master switch information being transmitted to the EEC or HMU(HPSOV), or that the LPSOV was closed by operating the master switch or fire switch, cutting off the fuel supply and causing the HPSOV to close due to spring force (see Figure 50-1).

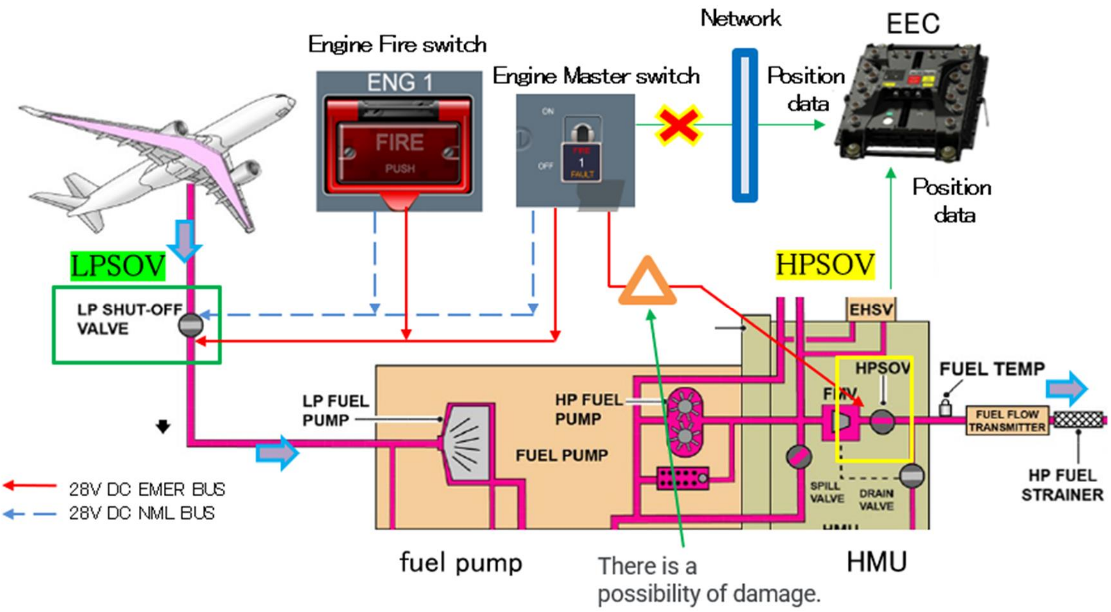

Figure 50-1 Relationship between HPSOV, LPSOV, and EEC
(additions to the diagram provided by Airbus)

When there is no AC power available, the electrical system reconfigures up so that the 28V DC EMER BUS is powered by the emergency battery, but no power is supplied to the 28V DC NML BUS. Based on this, it is estimated that the only power source for driving the LPSOV motor when the engine was shut down was the emergency power source (28V EMER DC BUS) (see Figure 50-2) .

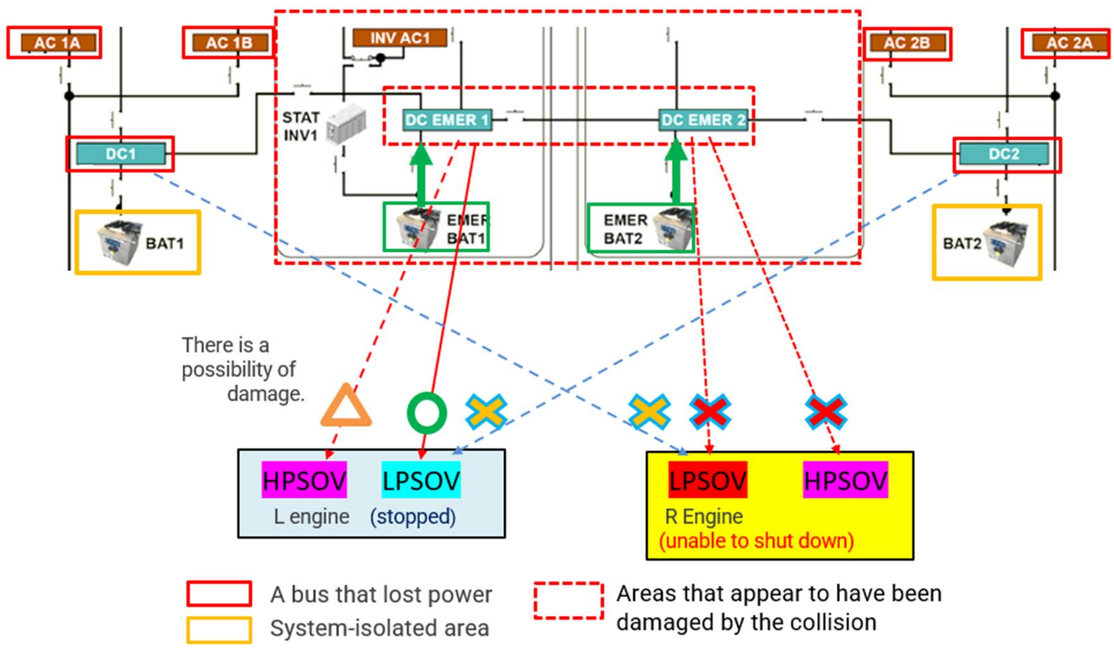

Figure 50-2 Electrical Wiring Diagram for Engine Shutdown System
(additions to diagram provided by Airbus)

The right engine was damaged immediately during the collision and its EEC lost signals from the aircraft network, but continued to run independently. Due to the engine's design, even if control from the aircraft is interrupted, a dedicated generator ensures power and allows for independent operation. The engine speed is unknown, but an acoustic analysis showed that the engine RPM maintained near-idle power.

The right engine was taken to shut down after the left engine, but did not shut down. At this time, the right engine's HPSOV and LPSOV were powered by the right emergency power source (28V EMER DC BUS2), but it is highly probable that neither of them were activated (see Figure 50-2). In addition, because the data link between the right engine and the aircraft was severed, no engine information was displayed in the cockpit, and the flight crew members were unable to recognize that the engine was still running.

The reason why the HPSOVs of the right engines did not operate, and the EEC of the left engine was unable to recognize the position of the master switch, was probably due to damage to the wiring around the master switch and damage related to the EPDC. In particular, there was a wiring hub (terminal module) near the forward bulkhead of the damaged avionics compartment, and it is highly likely that this part was damaged. It is possible that damage to this part caused the HPSOV for the left engine to not operate.

The left and right LPSOVs have dual power circuits and, taking into consideration damage from fire or a frontal collision, are separately arranged within the fuselage so that the power is dispersed via the trailing edge or wing tip. However, in this accident, the AC power was lost, so the power circuit was only on the emergency power side, and the area from around the main landing gear well to near the right wing trailing edge was also damaged by the collision, so in addition to damage around the avionics compartment, it is possible that the wiring in the right LPSOV, which did not operate, was damaged in that area (see Figure 50-3).

The left engine LPSOV was found in the wreckage with its valve closed. The right LPSOV was completely destroyed by fire and could not be found in the surrounding wreckage (see Figure 50-4).

Figure 50-3： Left LPSOV Status after the Event
(additions to the drawing provided by Airbus)

(5). Fire Condition on Aircraft B

From the collision with Aircraft A, fire was present on Aircraft B on both engines and the main landing gear well in the center of the fuselage, and spread in the left engine side after the aircraft stopped. Immediately after Aircraft B stopped, smoke emanated from under the floor in front of L3 in the passenger cabin, gradually became thicker and more pungent, and five minutes after the Aircraft B stopped, it became impossible to see more than a few meters ahead, centered on the source of the smoke.

Directly below the source of the smoke was the area from the rear of the main landing gear well to the most forward part of the aft cargo bay. It is presumed that burning structural components and fuel from Aircraft A damaged the bulkhead aft of Aircraft B's main landing gear well, allowing the fire to spread inside of the aft cargo bay some time after the aircraft stopped(Figure 51-1).

At the time of the accident, there was no cargo loaded in the cargo bay, and it was empty.

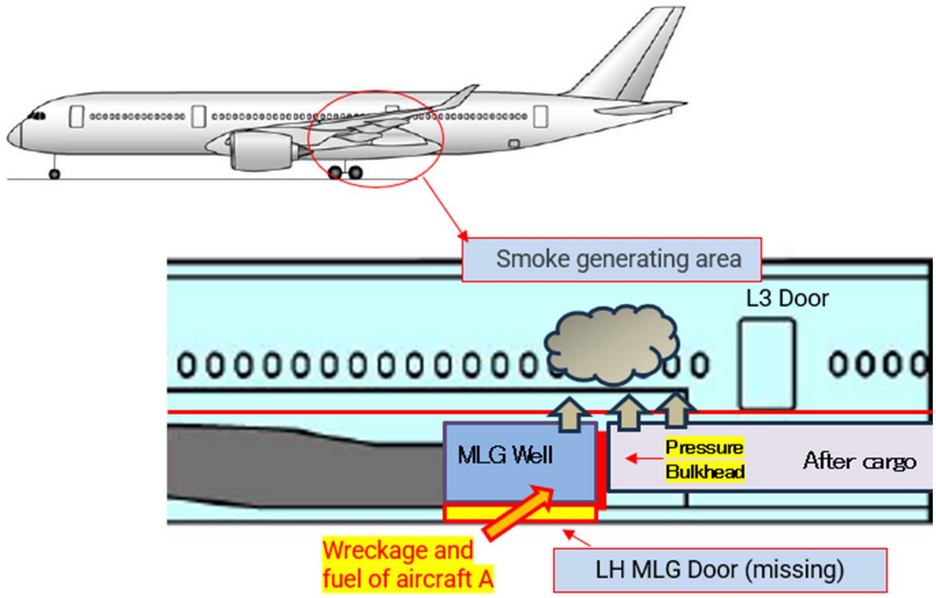

Figure 51-1 Damage to the Lower Fuselage of Aircraft B
(additions to the diagram provided by Airbus)

The firefighters who worked to put out the fire stated that they witnessed the right engine running with flames and sparks, liquid leaking from near the left main wing root, and a fire in the ceiling of the damaged main landing gear well.

About two minutes after the PIC B had evacuated from the L4 door having confirmed that everyone had evacuated, flames began to be visible through the L3 forward window, and the amount of black smoke from the open L4 door began to increase. This is believed to have been caused by a fire that was ignited at the time of the collision in the main landing gear well to the aft cargo compartment, causing smoke into the cabin, and then spreading to the passenger compartment.

Figure 51-2: Aircraft B on Fire (provided by passengers)

2.15 Medical Information

2.15.1 Aircraft A crew members

The exact cause of death for the five crew members is still being confirmed, but it is most likely that they sustained fatal injuries as a result of a strong impact from behind while seated.

PIC A suffered a serious injury, including burns to both hands and feet, in the fire that broke out after the collision.

2.15.2 Passengers on Aircraft B

One passenger suffered a broken rib. The passenger fell upon landing during the evacuation from L4. Four other passengers sustained minor injuries. In addition, 78 passengers reported feeling unwell, such as a sore throat or headache, and 12 of them sought medical attention.

2.16 Fire and Firefighting Information

2.16.1 Fire Conditions

(1) Aircraft A

According to the airport surveillance camera footage, the action records of the Tokyo Airport Office Local Response Headquarters, and the statements of airport firefighters, the fire on Aircraft A broke out explosively, mainly in the fuselage, immediately after the collision with Aircraft B. The fuselage then burst into flames, and the fire spread to parts scattered on the runway. The fire on Aircraft A was extinguished at 22:04 on the day of the accident.

(2) Aircraft B

According to the video materials provided by the passengers of Aircraft B, the airport surveillance camera footage, the action records of the Tokyo Airport Office Local Response Headquarters, and the statements of the passengers, crew members of Aircraft B and the airport firefighters, the outline of the fire on Aircraft B was as follows.

The fire on Aircraft B broke out near both engines and both main landing gear wells after the collision with Aircraft A.

The fire that broke out near the main landing gear well did not spread to the slides used for evacuation or their surroundings while the passengers and crew members were evacuating, but spread to the cabin immediately after all passengers and crew members had escaped (approximately 10 minutes after Aircraft B stopped). The fire spread to the cabin, then expanded toward the nose and aft direction in the cabin, and the outer panel in the center of the fuselage began to burn, spreading to the entire fuselage. Smoke was emitted from the cabin floor immediately after Aircraft B stopped, but the smoke did not fill the entire cabin at once, and gradually spread from the No. 3 door to the front and rear of the cabin. In particular, the passenger compartment behind door No. 3 was filled with a considerable amount of smoke by the time passengers in that area began to evacuate.

In addition, the fires that broke out in the left and right engines immediately after the collision with Aircraft A spread mainly to the inside of the engines after the Aircraft B stopped. The fire that broke out in the left engine grew in intensity immediately after the Aircraft B stopped, and spread to the grass around the engine. The firefighting team's initial efforts to extinguish the fire temporarily reduced the fire's size, but not enough to put out the fire. The right engine continued to operate despite the ongoing fire inside, and sparks continued to fly intermittently from the engine's exhaust port, while flames continued to blow from the right side of the fan case.

The fire that broke out on Aircraft B was extinguished at 02:15 the day after the accident.

2.16.2 Firefighting Situation

(1) Airport Firefighting

According to the activity records of the Tokyo Airport Office Local Response Headquarters, the activity records of Airport Security and Disaster Prevention Division, and the statements of the airport firefighters who were dispatched to the scene when the accident occurred, the firefighting after the accident was roughly as follows.

Haneda Airport has six airport chemical fire engines (hereinafter referred to as "fire engines"), and on the day of the accident, three fire engines were on standby at each of the two buildings (East Building and West Building). At the same time as the accident occurred, the control tower reported the incident by crash phone, and all the fire engines on standby were dispatched to the scene (see Figure 52-1). At that time, the airport firefighters on board each fire engine had not been aware of the full extent of the accident and had visually inspected the fire scene near the building where they were waiting, and had been dispatched to that scene. In addition, the airport firefighters who responded did not realize that the fire was in the CFRP aircraft.

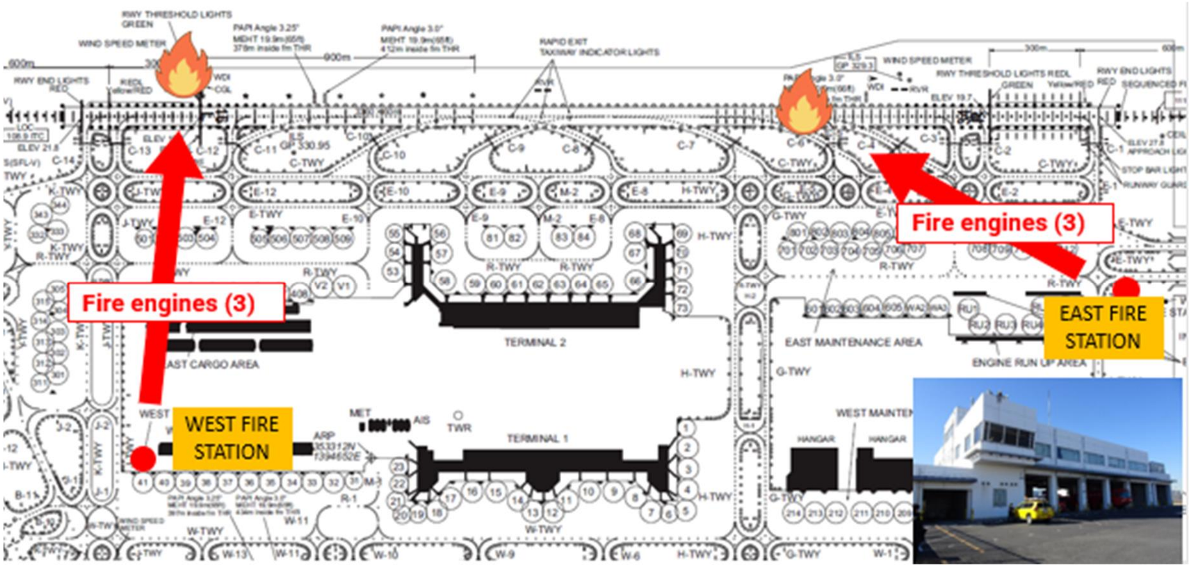

Figure 52-1 Initial Response of Airport Firefighting

The three fire engines heading for Aircraft A from the East Building approached Aircraft A from taxiway C5. When the fire engines arrived at the scene, there were three main large flames, and flames were also rising in various places in the surrounding area. Two fire engines were used to extinguish the fire in the fuselage, and one was used to extinguish a large fire on the runway in the northwest direction from the fuselage (see Figure 52-2).

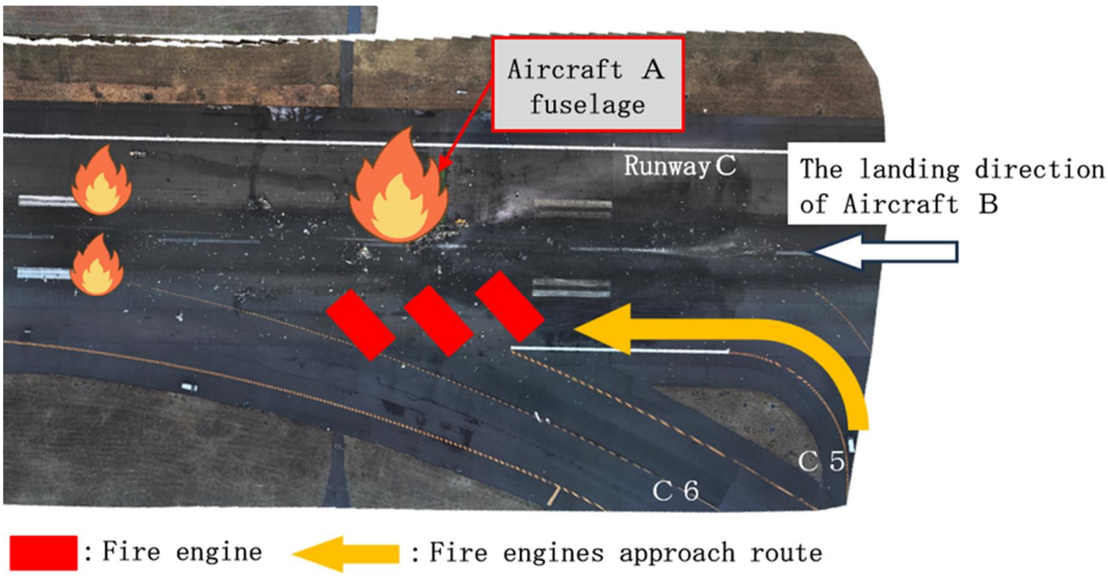

Figure 52-2: Situation When the Fire Engines arrived at the Fire Scene on Aircraft A

Meanwhile, when the three fire engines dispatched from the West Building arrived at the scene of the fire on Aircraft B, the airport firefighters on board recognized that a fire had started near the left engine and saw that the emergency evacuation of Aircraft B's passengers had begun from L1 and R1, and that the passengers who had escaped were retained around near the front of the nose. Therefore, in addition to giving instructions over the loudspeaker mounted on the fire engine, one airport firefighter got off to the ground and guided the passengers away from Aircraft B and to move to the rear of the fire engine. While guiding the passengers, water was sprayed to put out the fire near the left engine, and to cool Aircraft B to prevent the fire from spreading to the fuselage and the fuel loaded on the wings from igniting, and to allow the passengers time to escape (see Figure 52-3). When the airport firefighters got off the fire engine to guide passengers and check the fire situation, they confirmed that the right engine of Aircraft B was running. In addition, the crew members of Aircraft B had reported to the airport firefighters engaged in firefighting activities that all passengers and crew members had escaped.

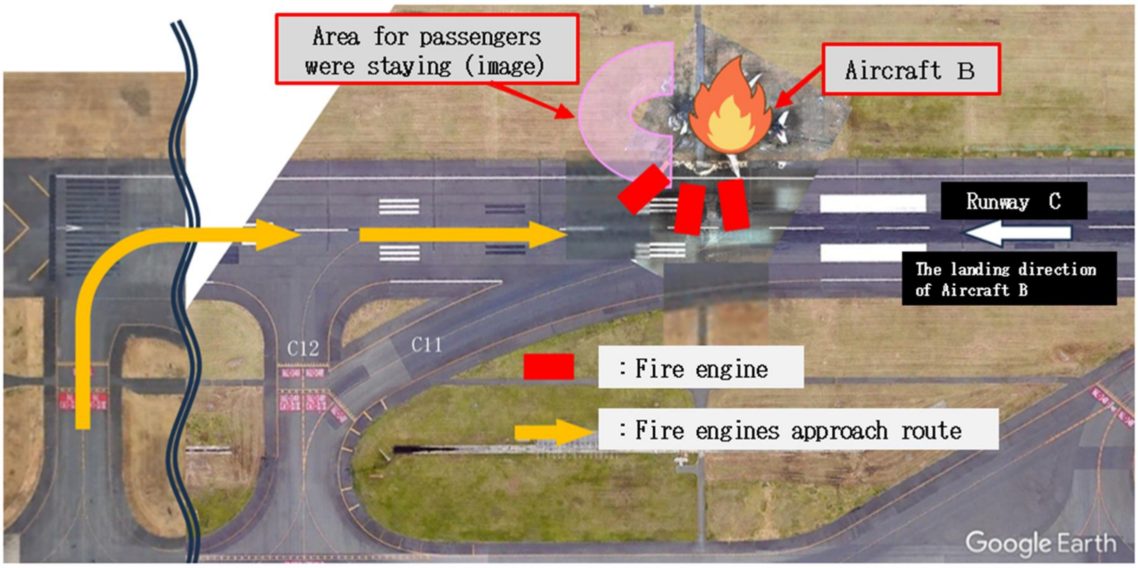

Figure 52-3 Situation when Fire Engines Arrived at the Fire Scene on Aircraft B

When the fire first broke out, three fire engines were deployed to each of the two fire scenes. However, two of the three fire engines that had been fighting the fire on Aircraft A returned to the building to fill up with water, and then headed to the fire on Aircraft B, leaving a total of five fire engines engaged in the firefighting on Aircraft B.

While firefighting efforts continued on Aircraft B, buses to transport evacuated passengers to the terminal building began to gather at Spot No. 505, making it necessary to guide the passengers to that spot. One fire engine led the passengers to the spot when returning to the building to get water (see Figure 52-4).

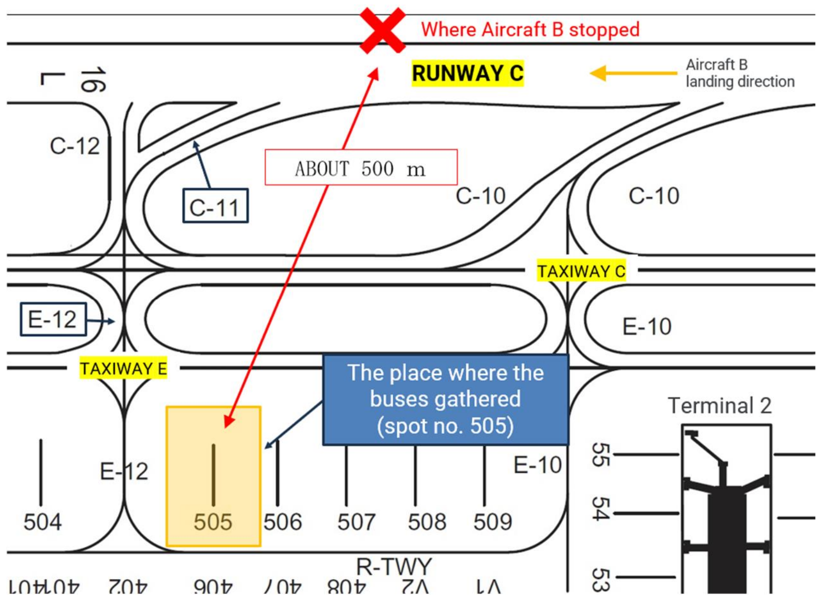

Figure 52-4　Spot 505

Runways A, B, and D, other than Runway C where the accident occurred, resumed operations at 21:29. Upon resuming operations, three fire engines left their duties to extinguish the fire that had broken out on Aircraft B in order to stand by for the runway operations to begin.

(2) Firefighting Activities by the Tokyo Fire Department

At the request of the airport office, the Tokyo Fire Department conducted firefighting activities for the fire that broke out in this accident using 80 vehicles and an unmanned water cannon vehicle. The Tokyo Fire Department vehicles dispatched in response to the request gathered at the predetermined entrance to the airport, but had to move through the airport under the guidance of the airport office to the fire scene on the runway. For this reason, the Tokyo Fire Department vehicles waited for a guide vehicle at the entrance for a while, and then moved through the airport under the guidance of the airport office to the fire scene on the runway.

At the scene of Aircraft A, in addition to firefighting activities, a search was conducted for the crew members of Aircraft A. When the Tokyo Fire Department vehicles arrived at the scene of the fire on Aircraft B, the passengers and crew members of Aircraft B had already completed to evacuate, and the fire had spread throughout the fuselage of Aircraft B. After that, they carried out firefighting activities on the fire that broke out on Aircraft B.

Furthermore, firefighters from the Tokyo Fire Department were also unaware that the fire was on an aircraft whose main structural component was CFRP, and so carried out firefighting efforts using their regular equipment.

(3) Extinguishing Agents Used to Extinguish the Fires

Protein foam extinguishing agents were used to extinguish the fires on Aircraft A and Aircraft B. Powder extinguishing agents were also used on Aircraft A. Seawater was used to extinguish the fire on Aircraft B.

2.17 Information about Search, Rescue, Evacuation and Others Related to Person' Life and Death and Injuries

2.17.1 Search for Aircraft A Crew Members

After escaping from Aircraft A on PIC A's own, PIC A remained in the grass on the east side of the scene. He then moved to the front of an airport fire department vehicle that was engaged in firefighting activities on Aircraft A, and was found by airport fire department personnel engaged in firefighting activities at 18:29. After first aid was administered by SRT personnel, PIC A was transported by a Tokyo Fire Department ambulance at 20:12, and admitted to the hospital at 20:29.

The other five crew members were searched for by the airport office, the Tokyo Fire Department, and the JCG, all were found inside and around Aircraft A, but it was confirmed that they sustained fatal injuries at the scene.

2.17.2 Emergency Evacuation of Aircraft B

After Aircraft B stopped, an emergency evacuation of passengers was conducted, and three exits, L1, R1 and L4, were used. The other exits were not used for evacuation because fires were confirmed outside.

The cabin crew member in charge of L1 (L1 cabin crew) and the cabin crew member in charge of R1 (R1 cabin crew) received evacuation instructions directly from PIC B, opened the doors and carried out the evacuation. On the other hand, the cabin crew member in charge of L4 (L4 cabin crew) was unable to receive instructions from PIC B or the other crew members, but in light of the increasing amount of smoke, L4 cabin crew decided that a quick evacuation was necessary. L4 cabin crew checked the external situation, confirmed that there were no fires or fuel leaks, and confirmed that there was enough space to deploy the evacuation slides, then opened the doors and began the evacuation.

Of the slides used for evacuation, L1 and R1 had a gentle slope because the front of the Aircraft B was lowered due to the broken nose gear, and passengers stopped midway when sliding down the slide. On the other hand, the slope of the L4 slide was steep because the Aircraft B had tilted forward and the floor height of the L4 exit was higher than normal. As a result, many passengers fell when landing. All of the slides used for evacuation landed on grass (see Figures 53-1 and 53-2).

Figure 53-1 L1, R1 and L4 Slides (provided by passengers)

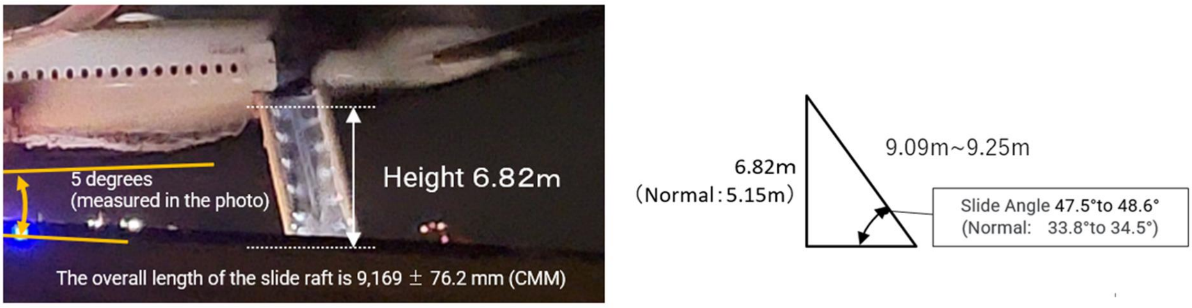

Figure 53-2 L4 Slide Height (provided by passengers)

After the evacuation, passengers who had escaped from L1 and R1 were guided to safety by the crew members of Aircraft B and the airport fire department, but some of the passengers who escaped from L4moved to the grass area behind the aircraft, along with two employees of the JAL group company who were also on board as passenger. The two employees of the group company, receiving advice over the phone from their superiors and their cabin crew member friend, gathered the remaining passengers and moved toward the terminal. The passengers who were being guided by the group company employees were found by other airline employees working at a nearby apron and were guided to Spot 505 where other passengers were being evacuated. The crew of Aircraft B, including PIC B and the cabin crew members, who were the last to evacuate from L4, and the airport authorities were not aware of the situation.

In addition, the company has been conducting training for ground staff on emergency evacuation measures based on the safety measures taken as a response to the emergency evacuation accident that occurred at New Chitose Airport on February 23, 2016, and the two employees of the group company who escaped from L4 had taken this training. Based on their experience in the training, the employees in question gave instructions to passengers around their seats in order to assist the cabin crew members after the aircraft came to a halt.

Regarding the task of counting the number of passengers and crew members after the evacuation, after making sure that no passengers remained on the aircraft, taking into consideration the low temperature, and the fact that the passengers were spread over a wide area, PIC B decided to stop counting the number of passengers after the evacuation at the scene, and instead moved the passengers to the airport terminal where a final check was made. At 20:45, it was confirmed that all passengers on board Aircraft B were safe.

2.17.3 Accident Response at Haneda Airport

In preparation for the occurrence of an aircraft accident or an incident that may result in an aircraft accident at Haneda Airport, the airport office has established a plan to determine the coordination procedures for relevant organizations to respond to the incident in advance and to conduct firefighting and rescue and medical rescue quickly and appropriately.

In the event of an accident at Haneda Airport, the airport office will notify relevant organizations, and the plan will be activated when a request for firefighting or medical rescue is made. At the same time as the plan is activated, a local operation headquarters or a local joint response headquarters will be established, and a firefighting and rescue cooperation team will be organized with the mission of supporting firefighting and rescue activities and medical rescue activities conducted by medical institutions.

The Fire and Rescue Cooperation Team is made up of the airport office and companies located in the airport, and is divided into a Fire and Rescue Team, a Security Team, an Emergency Vehicle Response Team, and a Guidance team. Of these, the Guidance Team is designated to "guide uninjured persons, etc."

After the accident occurred, the airport office received a firefighting request from the airport control center and set up an on-site operation headquarters headed by the airport director (17:47). The airport fire department then requested a response from the Tokyo Fire Department, and the plan was put into action.

An on-site command center and a local joint operation headquarters were then established.

2.18 Test and Research Information

2.18.1 Verification of Visibility of Exteria Lights on DHC-8-315 Aircraft

To obtain reference for the visibility of Aircraft A from the cockpit of Aircraft B on final approach, a verification was conducted on January 29, 2024 under the following conditions.

-Aircraft used: Same type as Aircraft A

-Verification location: Haneda Air Base Apron

-Verification items and exterior lights turned on: As shown in Table 4.

-Observer position: Location simulating the position of the cockpit of a landing aircraft on final approach (Horizontal distance 400.8 m behind, approximately 2.8° upward)

-Celestial phenomena at the time of verification: Nighttime (1 hour after sunset, 30 minutes after the end of normal twilight), no moon

Table 4 Verification Items and Exterior Lights that were Turned on

Verification items	Exterior lights turned on
Taxiing	1, Right wing tip position light (green) 2, Left wing tip position light (red) 3, Taxi light 4, Upper tail position light (white) 5, Lower tail position light (white) 6, Anti-collision ramp light (red)
When the accident occurred: After entering the runway	1, Right wing tip position light (green) 2, Left wing tip position light (red) 3, Taxi light 4, Upper tail position light (white) 5, Lower tail position light (white) 6, Anti-collision strobe light (white)
Take off	1, Right wing tip position light (green) 2, Left wing tip position light (red) 3, Taxi light 4, Upper tail position light (white) 5, Lower tail position light (white) 6, Anti-collision strobe light (white) 7, Left & Right Flare light 8, Left & Right approach light

As a result of the verification, the anti-collision ramp light (red strobe) and the upper tail light position light (white) located at the center of the horizontal stabilizer of the aircraft in use, as well as the anti-collision strobe light (white strobe) and the lower tail light position light (white) located in the tail of the fuselage, were visible from the upper rear (see Figure 54).

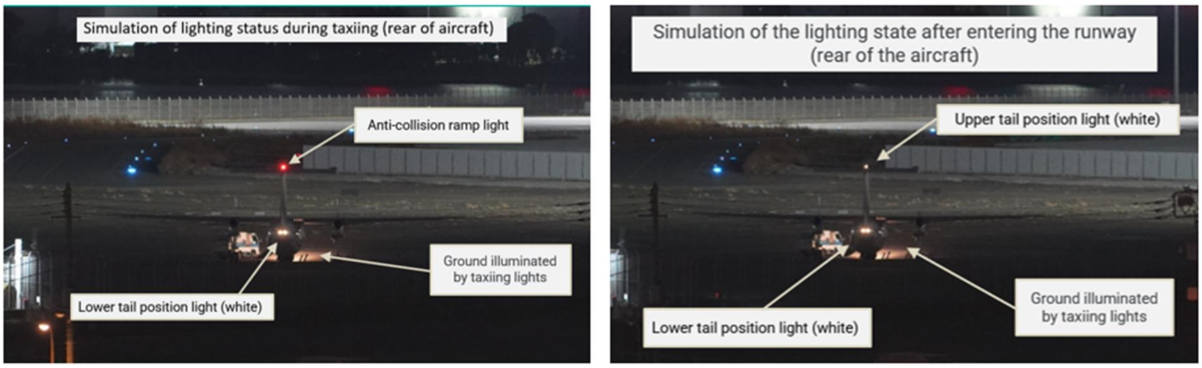

Figure 54: Photos Taken during Light Visibility Verification by the Same Model of Aircraft A (photos taken on January 29, 2024)

2.18.2 Verification Using an A350 Simulator

On April 17 and August 31, 2024, an A350 simulator was used to verify the relative positions of the HUD display during the final approach to Runway 34R, the runway, airport lights, and aircraft on the runway (an image of an aircraft simulating Aircraft A was displayed at the location where Aircraft A is estimated to have been stopped at the time of the accident), and to collect data such as the pilot's eye movements during the flight.

The simulator used in the verification is a device designed for the purpose of training pilot procedures, so the flight data and simulation images do not completely reproduce the actual flight conditions and scenery. Figure 55-1 shows an image in which the symbols are displayed brighter than when PIC B and the Training Crew actually used the HUD. Figure 55-2 shows the image of Runway 34R as seen by the safety pilot in the observer seat who does not use the HUD. To serve as a reference for future analysis, the pilot's eye movements during the final approach to Runway 34R were recorded with an eye tracker, and flight data was collected from the final approach to the completion of the go-around operation.

a The location where Aircraft A was stopped was approximately 150 m northwest (in the direction of landing) of the aiming point for touch down on the runway for Aircraft B's final approach (the point, but at night, is on the runway centerline directly beside the PAPI).

b The Flight Path Vector display on the HUD during Aircraft B's final approach was close to the final approach descent target point until the flare operation began.

c Aircraft A was stopped in a position where the runway centerline lights and touchdown strip lights were embedded in the runway surface, and the upper tail light, lower tail light and anti-collision lights attached to the tail of Aircraft A, which were visible from behind, were approximately in the same line as the row of runway centerline lights.

d During the final approach, the pilot checked not only the displays in the HUD but also conventional instruments such as the PFD to confirm the flight situation.

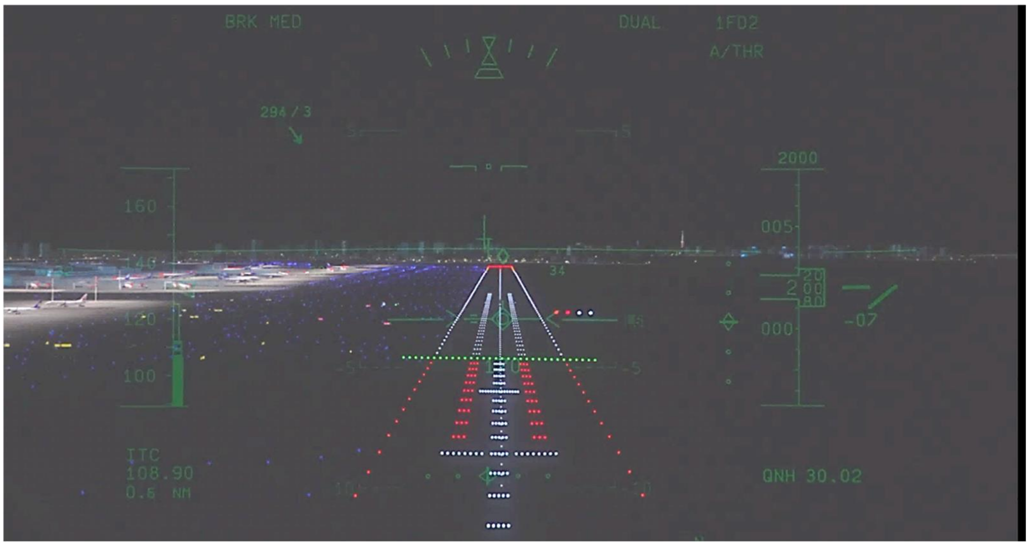

Figure 55-1 Runway 34R Seen through the HUD
(Photo taken during simulator verification)

Figure 55-2 Runway 34R as Seen from Aircraft on Final Approach
(Photo taken during simulator verification)

2.19 Organization and Management Information

2.19.1 Japan Coast Guard

2.19.1.1 Rules of JCG

(1) JCG 's Aircraft Operations Manual Bombardier DHC-8-315 has the following description: (excerpt)

a CREW COORDINATION *40

3 - 1 - 4 CREW COORDINATION AND SCAN POLICY

1 CREW COORDINATION

(omitted)

(7) During ATC *41 *communications conducted by PM, PF shall indicate their intention to comply with the ATC instructions by saying "ROGER", the word "OK", "Thumb up" or "Nod" if their complies with such instructions, or by giving the necessary Intention to PM if they cannot comply with such instructions. If there is no indication from PF, PM should reiterate the content of the communication to PF.*

(omitted)

(9) Crew understands that the proper execution of procedures, such as each party working responsibly in their assigned tasks with an accurate understanding of the purpose of the work and the other party checking that the work is being done correctly, will maintain good Crew Coordination and will ensure that the traditional communication of intent by Order is also carried out. Understanding that the communication of intentions made by the Order is also carried out.

(omitted)

2 STANDARD RESPONSE TO ORDER

(1) PF shall order the contents to be operated in order of priority at the appropriate time considering the situation in each PHASE, and in principle, when multiple operations are to be performed, the next operation shall be ordered after confirming that one operation has been completed.

(2) When PF operates by itself, it is standard to call out the words of the operation, and when ordering to PM, it is standard to add a verb before the operation to be performed as a rule.

(omitted)

(3) In principle, PM shall Acknowledge by reciting the PF's order. When to execute the Before Takeoff Checklist

3 - 1 - 3 CHECKLIST

(omitted)

The basic timing of execution shall be as follows:

Checklist	*From*	*Until*
(omitted)	(omitted)	(omitted)
BEFORE TAKEOFF	*Line Up Clearance*	*Takeoff*

*40 "Crew Coordination" means that each pilot shares the control tasks defined for each phase of the flight.

*41 "ATC" refers to air traffic control, the purpose of which is to prevent collisions between aircraft or between aircraft and obstacles in the airspace in which they fly, and to form ensure an orderly flow of air traffic.

(The following omitted)	(The following omitted)	(The following omitted)

*(2) JCG's Aircraft Training Manuals, Bombardier type DHC-8-315, contain the following description: (excerpt)*a Procedures to be taken after receiving clearance to enter the runway from ATC

Chapter 1 Training Procedures

1-2-5 TAXI

(omitted)

L P[*42]	*R P*[*43]
Upon receipt of the clearance from ATC for runway approach, perform the following steps	
    *Call "**Before Takeoff Checklist**"* *Call "**Standby Checklist**"*	*Bleed Air Flow Selector ··········MIN* *Bleed Air Sws ············As Required* *Anti-Collision ················ WHITE* *RADAR ·········· ·············On* *Perform Checklist as directed by LP* *Call" **Dot Line**"*

b When to perform a Control Check of the control system

Chapter 1 1-2-5 TAXI

(omitted)

L P	*R P*
Check and hand over Control at the appropriate time and in the following manner.	
Call "Gust Lock Off, Check Control"	*Call "Gust Lock Off, Check Control"* *Check the operation of the Aileron and Elevator by removing the Gust Lock as instructed by LP.* *Gust Lock ·································· Off* *Control ···································· Free*
When you are facing a Runway Heading, have your left hand to the Control Wheel.	*Call "**Control Free**"*
*Call "**I have Control**"*	*Call "**You have Control**"*

c Procedures to be performed prior to runway approach

Chapter 1 1-2-5 TAXI

(omitted)

■ Before the start of taxi, before passing through intersection, etc., and before entering the runway, both pilots should call out to ensure safety checks on both sides.

If there is no other Pilot's Call, Order or Confirm shall be made.

*42 "LP" refers to the pilot in charge of the left cockpit, and 'RP' refers to the pilot in charge of the right cockpit. It is used to divide work assignments according to seating position and is mainly used when the aircraft is on the ground.

d Procedures to be taken after receiving Take Off Clearance from ATC

Chapter 1 1-2-5 TAXI

(omitted)

L P	*R P*
Upon receipt of the Take Off Clearance from ATC, the following steps should be taken	
       Call " ***Continue Checklist*** *"*	*Pitot Static Heater Sws ········On* PITOT HEAT 1 PITOT HEAT 2 *Confirm Caution Light is off* *(All Caution Lights are turned off at this point)* *Landing& Taxi Light ···· On/(Pulse)* *Transponder ··················ALT* *Execute remaining items as instructed by LPCall* ***"Before Takeoff Checklist is Completed "***

e Procedures to be performed during normal takeoff

Chapter 1 1-2-6 TAKE OFF

1 NORMAL TAKEOFF

(omitted)

Pilot Flying (PF)	*Pilot Monitoring (PM)*
■*Confirm that the aircraft is properly lined up and the RWY Heading matches the EHSI and RMI Heading* (omitted) ■ *If the HDG can be confirmed on the parallel taxiway, etc., the HDG reading on the RWY can be omitted.*	
*(Call "****Heading*** *ooo")*	*(Call "****Heading*** *ooo")*
*Call "****Take Off****"*	*Call "****Take Off****"*
・After advancing the PWR Levers to about 40% and confirming ENG Stabilize, Smoothly release the Brake while advancing the PWR Lever.	*When the ARM Segment of the Auto Feather Sw lights up* *Call "Auto Feather Arm".* *If not, Call* *(Call "No Auto Feather")*
*Call "****Set Power****"*	*Call "Set Power* *Set Takeoff PWR as instructed by PF*
(The following omitted)	(The following omitted)

2.19.1.2 Crew Composition, Roles of Ground Crew and Flight Crew (Duties)

(1) JCG's Coast Guard Aircraft Personnel Duties Regulations include the following description of the duties of flight crew members. (Excerpt)

(Duties for the staff of the flight division)

Article 2 Chief Aviation Officer shall be in charge of all operations related to the operation of aircraft and shall direct and supervise the subordinate staff of the Flight Division.

2 1st Aviation Officer shall assist Chief Aviation Officer, organize the work set forth in the preceding paragraph, and shall divide the work set forth in the preceding paragraph as Chief Aviation Officer may determine, and shall direct and supervise 2nd Aviation Officer, 3rd Aviation Officer.

(omitted)

(Duties for staff of the maintenance division)

Article 3 Chief Maintenance Officer shall be in charge of all operations related to the maintenance of aircraft or equipment installed at Japan Coast Guard Air Station or Air Station (excluding maintenance of communication facilities. The same shall apply hereinafter in this Article). and shall direct and supervise the subordinate staff of the Maintenance Division.

(omitted)

4 Maintenance Officer shall engage in the work described in paragraph 1 as determined by the head of the Maintenance Division.

5 Maintenance personnel shall be engaged in assisting the work described in paragraph 1 and other work of the Maintenance Division.

(Duties for the staff of the communication division.)

Article 4 Chief Communication Officer shall be in charge of all operations related to the execution of communications or maintenance of communications facilities in aircraft or at Japan Coast Guard Air Station or Air Station and shall direct and supervise the subordinate staff of the Communication Division.

(omitted)

4 Communication officer shall engage in the operations specified in paragraph 1 (except those related to the airborne high-performance surveillance radar) as determined by Chief Communication Officer.

(omitted)

7 Search RADAR Officer shall engage in the work described in Paragraph 1 (limited to those related to aeronautical high-performance surveillance RADAR) as determined by the Director of Chief Communication Officer.

(omitted)

Article 5 Duties to be performed by staff on board an aircraft as flight crew members shall be in accordance with the classifications in the following table.

Pilot In Command	*Under the orders of the person who commands an aircraft pursuant to the provisions (Japan Coast Guard Instruction No. 25 of 1971, hereinafter referred to as "Operational Rules")*

	of Article 5, paragraphs 1 through 5 or Article 20 of the Japan Coast Guard Aircraft Operation Regulations, he/she shall pilot an aircraft or engage in other aircraft operations, and shall command and supervise those who perform their duties on board such aircraft.
First Officer	*Assist Pilot In Command in the operation of the aircraft.*
Onboard Communication Officer	*Operate radio equipment (excluding airborne high-performance surveillance RADAR) Operate radio equipment installed in aircraft.*
Onboard RADAR Officer	*Operate airborne high-performance surveillance RADAR.*
Onboard Maintenance Officer	*Monitor the condition of the aircraft, the operation of the engine, the instruments and warning lights, and check for unusual conditions and performance.*
Onboard Airperson	*To operate equipment used for security and rescue operations, such as watchtowers, dropping devices, lifting devices, etc., necessary for aircraft operations, and to perform other security and rescue operations, etc.*

(2) The Haneda AS Administrative Division Regulations for Haneda AS contain the following description of the duties of the Specialist Officer, Flight Division, Maintenance Division and Communication Division. (Excerpt)

Article 3 The Specialist Officer shall be in charge of the following affairs.

(1) Planning and coordination of aircraft operations

(2) To provide operational support for aircraft and to prepare and keep records related to aircraft operations.

(3) Coordination of the use of airports for aircrafts.

(4) Cooperation, assistance, and liaison with the National Police Agency, prefectural police, customs, quarantine offices, and other relevant administrative agencies (limited to those pertaining to the operation of aircraft belonging to the).

(omitted)

Article 5 Aviation Division shall take charge of the following affairs.

(1) Matters related to general affairs within Aviation Division.

(omitted)

(4) Matters related to applications for operations under the Civil Aeronautics Act.

(omitted)

Article 6. Maintenance Division shall take charge of the following affairs.

(1) Matters related to general affairs within the Maintenance Department.

(omitted)

(5) Matters related to ground support operations necessary for aircraft operations (limited to those under the jurisdiction of the Maintenance Division).

(omitted)

(11) Matters related to the preparation, organization, and storage of records necessary for the maintenance of aircraft belonging to the Air Station and items under the jurisdiction of the Maintenance Department.

(omitted)

(17) Matters related to the operations of work vehicles and wagons.

(omitted)

Article 7. Communication Division shall be in charge of the following affairs.

(omitted)

(1) Matters related to general affairs within Communication Division of Correspondence.

(omitted)

(3) Matters related to the management of radio stations.

(omitted)

(9) Matters related to the execution of correspondence.

2.19.2 Japan Airlines Co., Ltd.

2.19.2.1 Regulations on the Use of HUD

(1) FCOM*43

The standard procedurse,s "STANDARD OPERATING PROCEDURES BEFORE PUSHBACK OR START" contain the following description of the use of the HUD:

HUD

HUD................................DEPLOY BOTH

HUD knob ....ON BOTH

Turn on the HUD and adjust the brightness according to conditions.

DISPLAY MODE.................... AS RQRD BOTH

Select the declutter mode as required.

The flight crew should select the crosswind mode only in flight, when the FPV is not within the display area of the HUD.

(2) Training Materials

Cautions for using the HUD are given in the Practical Reference*44.

A2.17.4.6 HUD Key Words

· *HUD / PFD*

Some things, such as TCAS, can only be handled by the PFD, so use the HUD and PFD accordingly.

If you have any doubts about the information on the HUD, it is important to look at the PFD without hesitation

· *Brightness adjustment is important*

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*43 "FCOM" stands for Flight Crew Operating Manual, which describes the procedures that pilots must follow when operating an aircraft, restrictions that must be observed during operation, and procedures to be followed in the event of an emergency.

*44 "Practical Reference" refers to reference materials related to aircraft operations created by the company (Japan Airlines Co., Ltd.). Although this material is not binding like the procedures in the flight operations manual, it is intended to promote common understanding among pilots regarding the main methods of flight operations.

If the HUD is too bright, the HUD symbology may hide visual references (including PAPI) and other traffic. Particular care is required under low visibility conditions and during night flights, and brightness adjustment according to the situation is necessary. (There is no automatic adjustment function.) When using the HUD for the first time, the brightness is generally high, and as you become accustomed to the HUD, it generally becomes smaller.

(The rest is omitted)

2.19.2.2 Regulation for Safety Pilot

The Company's operations manual contains the following statement regarding the safety pilot.

5.5.4.2 Organization

When a co-pilot candidate[*45] *is to fly as a pilot, (omitted) a captain who has been appointed as a trainer or examiner must fly as a pilot, and a captain or co-pilot must also fly in the cockpit.*

5.5.4.3

Responsibilities and duties of flight crew members on board

5.5.4.3.1 (omitted)

5.5.4.3.2 Captains and co-pilots other than the PIC

In addition to the provisions of "5.3.4 Co-pilot" monitor the status of the co-pilot candidate in the cockpit, and if a difficult situation occurs, deal with the situation together with the PIC. In particular, always be prepared to take over ATC communications, and if necessary, do so at your own discretion or under the direction of the PIC.

The regulations for the "co-pilot" state the following:

5.3.4 First Officer

1. The First Officer, as the SIC in the formation, is responsible for assisting the PIC in all aspects of flight operations.

Note: SIC stands for Second-In-Command, and refers to the person who has command authority second only to the PIC in the formation. In addition, in a formation that includes replacement personnel, if a person with captain qualifications other than the PIC is on board, that person will become the SIC in the formation, but even in that case, the First Officer must perform his/her duties with the mindset of a SIC.

2. In preparation for any unforeseen circumstances that may occur at the PIC, the First Officer must endeavor to understand and master the PIC's responsibilities and duties at all times, and when he/she takes over command, he/she must take

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*45 "co-pilot candidate" corresponds to the term "Training Crew" used in this interim report.

appropriate measures in accordance with the provisions of Section 7.6 Emergency Measures III - Crew Incapacitation.

3. When carrying out his/her duties, the First Officer must always clearly recognize his/her own division of labor, monitor the work of the PIC, and endeavor to provide necessary confirmation or proactive advice to the PIC. He/she must also make necessary reports.

The Supplementary Documents contain the following information regarding points to note for those flying as safety pilots:

2.1.1.1.2 Important points for the on-board as safety pilot

1. The main role of a Safety Pilot is to be a PM. It is not their main purpose to take notes for juniors or give them advice for growth. They should be aware of being a PM when flying.

2. As with regular Co-Pilot Duty, they should participate in all phases of the flight. During briefings, they should be actively involved in the loop, such as identifying threats. On the other hand, as a PM, they should sometimes leave the loop and monitor objectively.

3. (Omitted)

4. They should be aware of problems and monitor the flight overall, including the flight status, including external watch, and checklist handling. If they have any doubts, they should proactively communicate what they have noticed, without being deferential to the PIC's experience, position, or training results.

5. ATC

· *ATC monitoring is a very important task for the Safety Pilot, (omitted) to monitor that the various rules are being followed and to advise and clarify any questions.*

· *Always be ready to take over. If necessary, do so at your own discretion or under the instruction of the instructor or checker.*

· *(omitted)*

6. Always monitor the Auto Flight System to ensure that the aircraft is flying as intended by the PF, and provide appropriate advice if there is a discrepancy. Confirm that other automated systems are in the desired state as well.

7. When the workload in the cockpit increases in a situation that is different from normal, pay particular attention to monitoring the entire system and actively offer advice.

8. When a First Officer candidate encounters a situation that is difficult to handle, support the task as much as possible and deal with it together with the instructor or checker.

9. (omitted)

10. (omitted)

2.19.2.3 Regulations on Cabin Crew Members Emergency Evacuation Procedures

Regarding emergency evacuation procedures for cabin attendants (on land), the company's Cabin Attendant Manual Safety states the following:

Chapter 5
5 Emergency Evacuation
3.emergency Evacuation

- *When cabin attendants detect the occurrence of an abnormal situation that may lead to an emergency evacuation, they immediately report the situation to the PIC. An abnormal situation is defined as the following:*

- If there is a fire on the aircraft
- If the cabin is filled with smoke
- If the aircraft tilts abnormally during takeoff or landing
- If an abnormal sound or impact is felt
- If a fuel leak or other leakage is detected

In the event of an emergency such as those mentioned above, and there is no disruption to flight operations, the PIC will promptly explain the situation to the cabin crew and passengers.

■ *Responses when abnormal sounds or impacts are detected during takeoff or landing*

➢ *Instructions for cabin attendants to prevent themselves and passengers from being shocked*

Continue to take the appropriate shock-protection position for the Cabin Attendant Seat until the aircraft comes to a complete stop.

Repeatedly instruct passengers to assume a shock-prevention position.

■ *Initiating and carrying out emergency evacuation*

➢ *After the aircraft has come to a complete stop, the flight attendants stand up and try to prevent passenger confusion and calm them down.*

➢ *Check the situation inside and outside the aircraft and confirm instructions from the PIC.*

➢ *The initiation and execution of an emergency evacuation will be under the command of the PIC (or, in the event of an accident to the PIC, the person who should perform the duties of the PIC in accordance with the order of command set out in OM 5-2-4, 2. hereafter referred to as the Deputy).*

【Example of communication phrases from the cockpit】

"Emergency Evacuation, Evacuate Emergency Evacuation, Evacuate"

In addition, if there is no immediate command from the PIC or designated crew after the aircraft has stopped and any of the following events occur and it is judged that there is a risk of a serious incident, the cabin attendants will endeavor to notify the PIC or designated official of the situation and will effectively initiate and carry out an emergency evacuation.

— Fire (including abnormal smoke emission)
— Fuel Leak

— Severe damage to the aircraft
— Flooding (when ditching)

(Omitted)

■ *Emergency evacuation procedures (items that apply only in the event of ditching are underlined)*

➢*Before starting an emergency evacuation, check the status of the escape routes, especially their height above ground, distance from fire, and relationship to waves or water surface, and guide passengers to the escape route that is available.*

☑ *No fires*
☑ *No fuel leaks*
☑ *There is enough space to expand the Slide/Raft (check the water level)*

➢ *Check the Door Mode and open the exit. If necessary, ask nearby passengers for assistance.*

➢ *During Slide/Raft inflation, passengers are instructed to unbuckle their seat belts, not carry any luggage, stand back, and not wear high heels or any other items that may damage the Slide/Raft.*

➢*After confirming that the slide/raft is fully inflated, give instructions to evacuate and guide passengers.*

➢ *Ask the helper for assistance. (If the helper cannot be selected in advance, select the helper.)*

➢ *Even after the evacuation has begun, monitor the situation on board and continue to give instructions to passengers not to take their luggage with them. Ask support personnel to instruct passengers not to take their luggage with them even when they leave their seats.*

➢ *Evacuation instructions should include the location of the escape exit, not carrying any luggage, not carrying any high heels or other items that may damage the slide/raft, inflating life jackets at the exit, etc., and should be given in easy-to-understand words, loudly, and with actions.*

➢ *During a ground evacuation, crew members will instruct passengers to move away from the escape slides as soon as they reach the ground.*

➢ *After a final check of the situation in the cabin, the cabin attendants will evacuate the cabin, taking with them any items that need to be removed. After that, they will guide the passengers to a safe place and check the situation. They will also take emergency and life-saving measures as necessary until the arrival of the rescue team.*

4. Non-Normal Situation Guidelines: ground evacuation

■ *General*

This section provides recommended guidelines for cabin crew response during ground evacuation.

(Omitted)

When ordering an evacuation, cabin attendants should give clear instructions in a strong, loud voice, such as:

- *"EVACUATE"*
- *"OPEN YOUR SEATBELT"*
- *"COME THIS WAY"*

(Omitted)

After the slide is inflated, verify that the slide is safe to use. (Omitted) Position yourself in a designated assist space in front of or behind the escape exit. Do not block the exits. Instruct passengers by gestures and verbal commands to reach the exits as quickly as possible.

Give clear instructions in a strong, loud voice, such as:

➢ Passenger Entry Doors

- *"FORM TWO LINES" (Dual Lane)*
- *"GO"*
- *"JUMP"*

(Omitted)

If an exit is not open or cannot be used safely due to some obstruction, prevent passengers from escaping through that door and keep them near that door until a nearby exit is identified. Once a usable exit is identified, redirect passengers to that exit, while forcefully explaining to passengers why that exit is not being used (e.g., "this door is no good" or "there is a fire outside").

Cabin attendants must monitor the progress of the evacuation and the status of the slides they are responsible for. They must ask helpers to assist them. (If helpers cannot be selected in advance, they must select helpers.)

Observe the situation on board and give continuous instructions to passengers not to take their luggage off. Ask support staff to instruct passengers not to take their luggage off even when they leave their seats.

If there is any change in the situation, such as if there is any doubt about the safety of the exit in question, the evacuation from that exit will be stopped and passengers will be redirected to other exits.

5. Emergency Evacuation Guidelines : Evacuation Procedures

- *Communicate and cooperate with the cockpit.*
- *If time permits, use the PA to:*
  - *Explain to passengers (escape routes, shock-prevention posture, and other necessary matters)*
  - *Select helpers*
  - *Instruct the removal of high heels and other sharp objects.*
  - *Maintain the crash-proof position until the aircraft comes to a complete stop.*

➢Implementation of the evacuation

- *Check that the aircraft is stopped.*
- *Move to the station assigned.*

- *Assess the safety of conditions inside and outside the aircraft.*
- *Follow the instructions of the PIC and begin evacuation procedures.*
- *Activate the EVAC signal (if equipped), if necessary.*

➢ *The Case that an Escape Route is Available*

- *Open the door.*
- *Pull the Manual Inflation Handle (if necessary).*
- *Instruct to passengers to stand back while the slide is fully inflated.*
- *Give clear (and forceful) instructions.*

  Take a defensive position in the assigned assist space.
- *All evacuation exits have designated assist spaces in front of or behind them.*

  By remaining in the assist space, an escape route is secured without interfering with the evacuation of passengers.

  If the assist space faces a vertical structure (partition, lavatory, galley, etc.), press your heels and upper back against the structure to ensure a clear escape route.
- *Instruct passengers to evacuate.*
- *Assess the situation inside the aircraft and on the slide to ensure the flow of passengers.*
- *Ask the helpers for assistance. (If the helper cannot be selected in advance, select the helper.)*
- *Monitor the situation on board and continually instruct passengers not to take off any baggage.*
- *Ask the helpers to instruct passengers not to take their luggage off the plane until they leave their seats.*

  (Omitted)
- *If there are no more passengers approaching your assigned exit or the opposite exit (if passenger flow is stalled), it is appropriate to:*
  - *Use strong, clear and positive commands to draw other passengers towards your exit and, if necessary and conditions permit, get the attention of flight attendants to move to the nearest exit aisle and redirect passengers towards your exit.*
    - *Keep watch and protect the exits.*

  (Omitted)
- *Following the last passenger, evacuate through your assigned door or the nearest exit.*

➢ *The Case that the Evacuation Exit is not Available*

- *To prevent passengers from escaping, the exits are blocked while informing passengers that they cannot use them.*
- *If your assigned evacuation exit is unavailable, perform the following tasks to complete the evacuation:*
  - *Establish passenger flow around unavailable exits.*
  - *Direct passenger flow to available exits.*
  - *Assess the usefulness of other evacuation exit.*
  - *Visually verify that passenger flow is established through available exits before redirecting passenger flow.*

— *Guide passengers to the nearest available exit by issuing appropriate instructions and using gestures to show passengers the route to the exit.*

(Omitted)

- *If there are no passengers approaching the assigned exit or the opposite available exit (passenger flow is stalled), take appropriate action as follows:*
  - *Direct other passengers to the nearest available exit with strong, clear, and positive directions. If necessary, and conditions permit, move to the nearest exit aisle to alert other flight attendants to redirect passengers to the nearest available exit.*
  - *Keep watch and protect the exits.*
- *Maintain watching the evacuation conditions in other cabins and at exits. Directing or redirecting passengers will help maintain an equal flow through each exit.*
- *Even after the evacuation has begun, they will continue to monitor the situation on board and provide instructions to passengers to prevent them from taking any luggage with them.*
- *Ask the helpers to instruct passengers not to take their luggage off the plane until they leave their seats.*

(Omitted)

2.19.2.4 Regulations on the Response of Cabin Crew members in the absence of Immediate Instruction to Initiate Emergency Evacuation

The Company's Operations Manual contains the following description the cabin crew members' response in the absence of immediate instructions to initiate an emergency evacuation:

7.10 Emergency evacuation

(Omitted)

3. Emergency evacuation is initiated and carried out under the command of the PIC (or, in the event of an accident to the PIC, the person who is to perform the duties in place of the PIC (hereinafter referred to as the "deputy") in accordance with the command order set out in 5.2.4.2 Order of Succession).

However, only when there is no immediate command from the PIC or the deputy after the aircraft has stopped, and any of the following A. to D. has occurred and it is judged that there is a risk of the situation developing into a serious incident, the cabin attendant will endeavor to notify the PIC or the deputy of the situation and will effectively initiate and carry out the emergency evacuation.

A. Fire (including abnormal smoke generation)

B. Fuel leak

C. Severe damage to the aircraft

D. Flooding (when landing on water)

(Omitted)

Regarding the order of succession, the company's operation manual states the following:

5.2.4.2 Order of Succession

During flight, the PIC In the event of an unforeseen incident, command authority will be passed on to the following within the formation:

1. SIC
2. First Officer
3. Lead Cabin Attendant

2.19.2.5 Procedures for Items to be Checked before Opening Doors and Deploying Slides in the event of Emergency Evacuation

With Regard to checking the condition of the escape routes before starting an emergency evacuation, the Company's Cabin Attendant Manual Safety states as follows:

Chapter 5 Emergency Evacuation
3. Emergency Evacuation
■ *Emergency Evacuation Response*
➢ *Check the status of the escape routes before starting an emergency evacuation. In particular, check the height above the ground and the distance from the fire, and guide passengers to an available escape route.*
☑ *There is no fire*
☑ *There is no fuel leakage*
☑ *There is enough space to inflate the slide*
(Response in case of water landing is omitted)

2.20 Other Necessary Matters

2.20.1 Regulations for Airport Fire Fighting Service

(The underlining is from the Japan Transport Safety Board.)

2.20.1.1 International Civil Aviation Organization (ICAO)

Annex 14

9.2 Rescue and firefighting

General

Introductory Note.— The principal objective of a rescue and firefighting service is to save lives in the event of an aircraft accident or incident occurring at, or in the immediate vicinity of, an aerodrome. The rescue and firefighting service is provided to create and maintain survivable conditions, to provide egress routes for occupants and to initiate the rescue of those occupants unable to make their escape without direct aid. The rescue may require the use of equipment and personnel other than those assessed primarily for rescue and firefighting purposes.

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Chapter 12 AIRCRAFT FIREFIGHTING AND RESCUE PROCEDURES

12.2 FIGHTING AIRCRAFT FIRES

12.2.1 The prime mission of the airport RFF service is to control the fire in the critical area to be protected in any post-accident fire situation with a view to permitting the evacuation of the aircraft occupants.

2.20.1.2 Civil Aviation Bureau, Ministry of Land, Infrastructure, Transport and Tourism (JCAB) "Standards for the Development of Firefighting and Rescue Systems at Airports" , revised on December 15, 2020

Ⅳ Firefighting and Rescue Services

4. Airport Firefighting and Emergency Services

Airport firefighting and emergency services are services that airport firefighters perform in the event of an aircraft accident or other emergency.

(1) (Omitted)

(2) Measures to be taken by airport firefighters

Airport firefighters shall follow the instructions of the person in charge and work with relevant agencies to take appropriate measures, such as suppressing and preventing fires on aircraft and other vehicles, setting up and protecting emergency escape routes, with the aim of saving lives. (The rest is omitted.)

V. Aircraft fire response

1. Aircraft fire extinguishing principles

When extinguishing an aircraft fire, in principle, a large amount of foam should be sprayed all at once when the fire engine arrives at the scene of the fire in order to suppress the fire. (Omitted)

2. Firefighting tactics

(1) (Omitted)

(2) Extinguishing fires by foam spray

Depending on the situation at the scene of the aircraft accident, necessary measures should be taken, such as covering the aircraft and its surroundings with foam to prevent the fire from spreading or to prevent the fire from starting and to secure an escape route for the passengers.

Foam spraying should be carried out based on the following items.

a *Foam spraying should be done in either a rod-shaped or fan-shaped manner depending on the type of fire.*

b *Fire engines should be positioned in a position that takes into account the range of their foam spray, and the fire should be controlled by spraying foam along the fuselage with the aim of securing emergency escape routes, etc.*

c *Foam spraying should be done to ensure an escape route in order to protect evacuees from the emergency escape route from the fire.*

d *In order to protect the fuselage from a wing fuel tank fire, foam will be sprayed first at the attachment points between the fuselage and the wing, and then toward the wing tips.*

e *Care must be taken when spraying the foam to suppress the fire so as not to reduce the effectiveness of the foam film covering already sprayed from the fire engine.*

(3) Preventive measures against danger to engines in operation

To prevent danger to engines in operation, care should be taken not to enter within the turning range of propeller aircraft, and within 10 m in front of and to the sides of the air intakes and up to 50 m behind the exhaust ports of turbojet aircraft.

(Omitted)

3. Fire extinguishing procedures by type

(1) (omitted)

(2) (omitted)

(3) Engine fire

a *In the case of a fire in the combustion chamber of a turbine engine, a fire engine should be placed on standby far enough away from the exhaust port to protect combustible materials from the fire that is being ejected.*

b *When cooling airframe structures near turbine engines, foam or water spray should be used, but foam should not be used inside the intake or exhaust ports of turbine engines unless there is a risk of combustion.*

c *If a fire breaks out inside the nacelle inside the engine (piston turbine), it is believed that the aircraft's fire extinguishing system can put it out, but if this cannot be done, dry chemicals are effective, although care must be taken as this can cause further damage to the engine.*

(The rest is omitted)

2.20.2 Counter Measures Taken after the CFPR Fire

2.20.2.1 Regulations of the Convention on International Civil Aviation

ICAO Circular 315 AN/169 Hazards at Aircraft Accident Sites contains the following description.

(The underlining is from the Japan Transport Safety Board.)

Chapter 3 HAZARDS

3.5 MATERIAL HAZARDS

3.5.7 Composite Material (omitted)

3.5.8-9 (omitted)

3.5.10

Other research suggests that exposure to the dusts of burnt composites may pose more of a problem than exposure to free fibres. What is clear at the present is that more research is required to be sure of the hazards and levels of risk posed by the range of materials.

3.5.11

There are other short term health effects resulting from exposure to the fibres and debris from impacted and combusted composites. Most notably, the fibres are highly irritant, particularly to the eyes, and also to the nose, throat and lungs. There is also still concern that partially burnt debris will cause contact hazards, such as dermatitis. Substances which are taken into the lungs with fibre and dust may also cause sensitization (allergies), which is a significant concern.

2.20.2.2 Safe Handling of Carbon Fibers

According to the Carbon Fiber Association's materials*46, the carbon fiber used as a material are thin in diameter, and individual fibers that are cut for any reason, tend to become dust and scatter into the air. Scattered carbon fibers can easily penetrate the skin and mucous membranes, causing pain, itching, and damage to the eyes and throat.

In areas where carbon fiber dust is likely to scatter, it is necessary to wear a mask*47 and goggles to prevent the skin exposure and inhalation of dust. Figure 56-1 shows an example of the personal protective equipment (hereinafter referred to as "PPE") to be worn when working at the scene of an aircraft accident that mainly a lot of CFRP materials are used, and Figure 56-2 shows the situation when working while wearing PPE.

*46 Carbon Fiber Association webpage (https://www.carbonfiber.gr.jp/tech/faq.html) "Handling Precautions", accessed on November 11, 2024

*47 According to Airbus recommendations for their own go-team personnel, the recommended dustproof performance of a mask to prevent the inhalation of carbon fibers is equivalent to the "FFP3" class."FFP3" is the dustproof performance indicated by the European EN standard, which is the international standard for dust masks, and corresponds to "DS3" in the Japanese certification standard.

Figure 56-1 PPE (Personal Protective Equipment) (provided by Airbus)

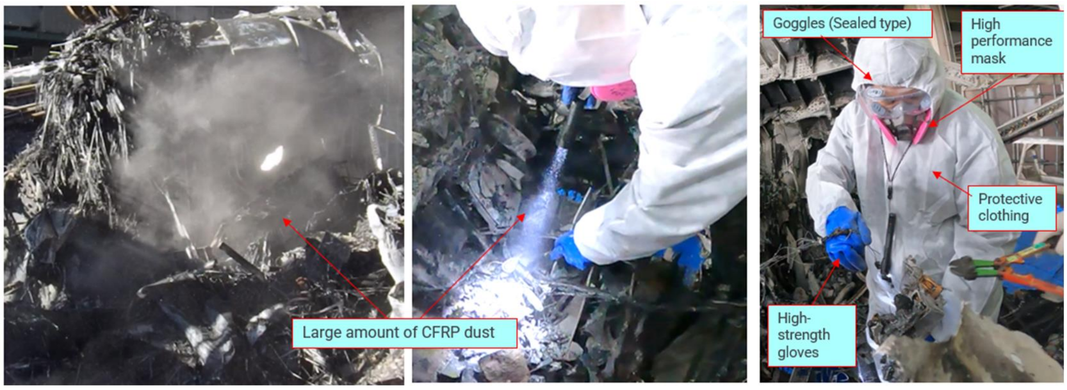


Figure 56-2 Situation at the Site (CFRP Dust, Protective Clothing)

2.20.3 Fire Resistance Standards for A350-900 Aircraft Certification

(1) The basic design of the A350-900 complies with the following standards:
EASA Certification Specifications 25, Amendment 8 – Large Aeroplanes except paragraph 25.795, at Amendment 9, except CS 25.795(b)(3)(iii).

(2) In addition to those listed above in the A350-900 type certification the European Aviation Safety Agency has added the following fire resistance standards for CFRP structures.

a Special Conditions (SC) D-16:

In Flight Fire - Composite Fuselage Construction

A. It must be demonstrated that the use of composite structural materials does not introduce any additional in-flight fire risks (e.g. reduced flame propagation resistance, emission of hazardous quantities of toxic products into occupied areas) that would not be present if the structure were of conventional aluminium alloy.

b Equivalent Safety Findings (ESF) D-15:z

Post Crash Fire - Composite Fuselage Construction

Instead of applying the flammability standards of CS 25.856(b) and corresponding Appendix F Part VII to the thermal/acoustic insulation materials installed in the lower half of the A350 fuselage, the following *approach shall be used as equivalent safety finding to the requirements of CS 25.856(b) for the A350 Type Certification:*

1. *The A350 composite fuselage shall be proven to present an equivalent level of resistance to flame penetration as a traditional metallic fuselage furnished with a CS 25.856(b) compliant insulation system.*
2. *It must be demonstrated that the levels of hazardous products such as smoke, toxic products and released composite fibres in the A350 occupied areas during an external post crash fire will be no higher than if the structure were of conventional aluminium alloy.*
3. *The flame penetration resistance test and smoke and toxic gases evaluation will be carried out in accordance with the test conditions prescribed in Appendix F Part VII as regards the fire threat with the following conditions:*
   - *(a) The test specimen will be a flat, plain composite panel representative of the minimum skin thickness found in the lower half of the fuselage. The corresponding A350 insulation material will be installed on the bask face of the panel.*
   - *(b) The test specimen will be mounted onto one face of an approximately 4"X4"X4" metallic box.*
   - *(c) The fire source will be the oil burner calibrated according to the test method of Appendix F Part VII.*
   - *(d) The test specimen will be exposed to the oil burner flame for 5 minutes and the environmental conditions within the box will be monitored during this period to assess the survivability.*
   - *(e) Smoke emission and toxicity will be assessed in comparative tests between a generic aluminium fuselage equipped with 25.856(b) compliant insulation and the A350 CFRP fuselage and insulation.*
   - *(f) The acceptance criteria will be:*
     - *No flame penetration within 5 minutes.*
     - *the smoke emission curves from the CFRP panel tests should not reach 10% light transmission significantly earlier than those from the aluminium construction tests.*
     - *Toxicity assessment will be based on the measurement of the concentrations of THC,HCN, SO2, CO and NOx measured in the "box" during the five minutes of the test. The concentrations will be compared to the acceptable limits identified by the FAA Technical Centre (ref. presentation "Update on Toxicity of Burn through-Compliant Insulation "held at the IAMFT WG, Atlantic City, NJ on 21. Oct. 2008, by Tim Marker (FAA-TC).*

c Special Conditions (SC) D-18:

Fire withstanding Capability of CFRP Wing Fuel Tanks

1) In the absence of applicable specific rule and guidance material, Airbus is required to show that the use of composite materials for the fuel tank *structure does not reduce the level of safety relative to existing experience with metallic structure.*

2) *This could be achieved by showing that:*

   – *from a fire withstanding capability, a composite wing is at least equivalent to a similarly sized aluminium structure.*

   Or

   – *a composite wing and fuel tank design, including any composite access panels, can endure an external fuel fed fire for at least five minutes.*

3) *The assessment shall be performed evaluating all relevant parameters, including fuel loading or external airflow. The ability to carry the relevant loads shall be demonstrated for in-flight fires as well as for under wing fires or post-crash fires. The assessment of in flight fire conditions is considered to be addressed under the threats to be defined for compliance demonstration to A350 Interpretative Material C-15. The study shall take into account the guidelines of ISO 2685. Composite structure being more sensitive to vibrations than metallic structures, those should be taken into account.*

3. DIRECTION OF FUTURE INVESTIGATION AND ANALYSIS

3.1 Overview

3.1.1 Summary of the Accident

Aircraft A departed from Spot N957 at Haneda Airport at around 17:32 on January 2, 2024 and headed for Runway 34R, which was designated for takeoff, in order to transport disaster relief supplies to Niigata Airport in response to the damage caused by the earthquake that occurred in the Noto Peninsula on January 1, 2024. As Aircraft A was to take off from Runway 34R, Tower East decided to have Aircraft A takeoff from Taxiway C5 using an intersection departure to ensure smooth takeoff and landing on the runway.

After Aircraft B received clearance from Tower East to land on Runway 34R, the control for Aircraft A was transferred to Tower East. Tower East instructed Aircraft A to taxi to the runway holding position on Taxiway C5 and informed that the takeoff order was Number one Aircraft A understood this instruction from Tower East to mean that it had obtained priority for takeoff over other aircraft and had been cleared to enter the runway, and so entered the runway and stopped there, but Tower East did not realize that Aircraft A had entered the runway and remained on the runway.

Aircraft B, which was not aware that Aircraft A had entered the runway, continued its landing approach, and collided with Aircraft A immediately after the touchdown.

As a result of the collision, fires broke out in both aircraft, and most of the fuselage of Aircraft A was destroyed, while the nose, underside of the fuselage, and landing gears of Aircraft B were damaged. After the collision, Aircraft B rolled down the runway and came to a stop on a grassy area beside the runway.

After Aircraft B came to a stop and all passengers and crew members on board evacuated, the fire that had broken out during the collision spread, destroying the fuselage, engine, and part of the main wings.

As a result of the collision, five of the six crew members on board Aircraft A sustained fatal injuries and one sustained a serious injury. Meanwhile, of the 379 passengers and crew members on board Aircraft B, one passenger fell down while evacuating and sustained a serious injury.

3.1.2 Contributing Factors to the Accident

It is probable that this accident occurred due to a combination of the following three factors. From the perspective of preventing future accidents from recurring, it is necessary to analyze the factors behind these three points and clarify the cause.

- Aircraft A understood that it had received clearance from the air traffic controller to enter the runway and entered the runway and stopped there.
- Tokyo Airport Control was not aware that Aircraft A had entered the runway or stopped on the runway.
- Aircraft B did not recognize Aircraft A, which stopped on the runway, until just before the collision.

3.1.3 Condition of Damage after the Collision

Regarding the damage caused by the collision between Aircraft A and Aircraft B, from the perspective of mitigating damage, it will be necessary to continue analyzing the following situations in the future.

- Collision between Aircraft A and Aircraft B and damage to those aircraft
- Emergency evacuation from Aircraft B
- Firefighting and rescue operations

3.2 Direction of Analysis regarding Aircraft A

3.2.1 Regarding the Fact that Aircraft A understood Having Received Clearance from the Air Traffic Controller to Enter the Runway, then Entered and Stopped on the Runway

From the following factual information, it is highly probable that the PIC A and the FO A recognized the instructions from Tower East to taxi to the runway holding point as the clearance to enter the runway and Aircraft A entered the runway.

- In the ATC communications and on the CVR of Aircraft A, it was recorded that Tower East gave an ATC instruction to Aircraft A: "Number one, taxi to holding point C5" (2.1.2.2 an Appendix 1).
- After Aircraft A correctly read back the control instructions from Tower East, no control communications between Tower East and Aircraft A were recorded (2.1.2.2 and Appendix 1).
- The PIC A stated that they were instructed by Tower East to enter Runway 34R from Taxiway C5 and wait (2.1.2.1).
- Immediately after the instruction, the PIC A instructed the FO A to perform a Before Takeoff Checklist be performed immediately after receiving clearance to enter the runway, and performed it (2.1.2.1, 2.19.1.1(2), 2.19.1.1(3) and Appendix 1).
- Aircraft A entered Runway 34R from taxiway C5 and stopped there (2.1.2.1 and Appendix 1).

3.2.2 Regarding the Fact that the PIC A and First Officer A's Understanding of the Taxiway Instruction from the Tower East to the Runway Stopping Position on Taxiway C5 as Clearance to Approach the Runway

The following factors are likely involved in the reason that the PIC A and the FO A recognized the instructions from Tower East to taxi to the runway holding point C5 as the clearance to enter the runway. Further analysis of the causal relationship between these factors and the occurrence of the accident is required.

(1) In addition to the late departure time of Aircraft A, because they wanted to have time for the flight crew members to return home after returning to Haneda Airport the flight crew members on Aircraft A were in a hurry to leave Haneda Airport. (2.1.2.1 and Appendix 1).

(2) The PIC A and the FO A were unaware of the presence of Aircraft B on approach because a landing clearance had been issued to Aircraft B before Aircraft A switched its ATC communications to Tower East frequency (2.1.2.2 and Attachment 1).

(3) That Tower East instructed Aircraft A to “Number one,” meaning that Aircraft A's takeoff order was Number one (2.1.2.1, 2.1.2.2 and Appendix 1).

(4) Regarding the fact that Aircraft A was given first priority for takeoff even though there was another departure aircraft ahead of it, PIC A recognized that Aircraft A had priority for takeoff because it had informed Tokyo Radio in advance that the purpose of the flight was to airlift relief supplies for the earthquake disaster (2.1.2.1).

(5) In response to FO A's readback of the ATC instruction “To holding point C5, JA722A. Number one, Thank you.” , PIC A confirmed by saying only “C5” and “Number one” (Appendix 1).

(6) While taxiing toward Taxiway C1, Aircraft A was instructed by Tower East to taxi to Taxiway C5, which implies they should prepare for a takeoff from intersection Taxiway C5. This reduced the time available to the crew in order to get ready for the takeoff (2.1.2.1 and Appendix 1).

(7) It is highly probable that PIC A and FO A were not aware that Aircraft B was approaching the runway and was about to land (Appendix 1).

(8) Aircraft A received radio communications from Comm A when Aircraft A entered the runway (2.1.2.1 and Appendix 1).

(9) Stop bar lights were not operational (2.8.1 and 2.9.1.1).

3.3 Direction of Analysis on Air Traffic Control (ATC)

3.3.1 Regarding the Fact that Tokyo Airport Traffic Control Tower did not Recognize that Aircraft A Had Entered the Runway and Had Been Holding on the Runway

According to the following facts, it is most likely that Tower East did not recognize that Aircraft A had entered and had been holding on the runway.

- From having seen Aircraft A turning to the Taxiway C5 till the occurrence of the accident, Tower East had never issued any ATC instructions to Aircraft A (2.1.2.2).
- From having seen Aircraft A turning to the Taxiway C5 till the occurrence of the accident, Tower East had never had any conversation with other air traffic controllers regarding movement of Aircraft A at the operation room (2.1.2.2).
- Tower East never instructed Aircraft B to go around (2.1.2.2).

3.3.2 Regarding the Fact that Tower East did not Recognize the Runway Incursion by Aircraft A

Regarding the fact that Tower East did not recognize the runway incursion by Aircraft A, the following factors likely cause it. Further analysis on the causal relation with occurrence of the accident is required.

(1) Tower East was visually monitoring five aircraft under its control, as well as two aircraft taxing on the Taxiway C to take off from Runway 05 (Runway D) (2.1.2.2 and 2.7.6).

(2) In response to the ATC instruction from the Tower East, Aircraft A correctly read it back, and then Tower East saw Aircraft A turning to the Taxiway C5 as instructed for an intersection departure (2.1.2.2).

(3) Upon receiving a request regarding the transfer intervals of arrival aircraft from AFS of Tokyo Radar Approach Control Facility, Tower East shifted its gaze from monitoring

outside the operation room to the airport surface monitoring screen installed on the control console. In the meantime, Aircraft A passed the holding point marking and entered the runway (2.1.2.2 and 2.7.6).

(4) 13 seconds before the accident occurred, Tower East received an inquiry about Aircraft B from DF of Tokyo Radar Approach Control Facility, and then monitored Aircraft B. At this time, DF assumed that Aircraft B would go around and inquired Tower East, because Aircraft A appeared to be on the runway on the screen displaying the airport surface. However, during all that time, Aircraft A had been holding on the runway (2.1.2.2 and 2.7.6).

(5) Tower East was monitoring Aircraft B because it needed to clear Aircraft A for line-up-and-wait without delay immediately after Aircraft B landed (2.1.2.2).

(6) Although a warning of the Runway Occupancy Monitoring Support System was issued 7 seconds after Aircraft A passed the holding point marking of Runway 34R and continued to be issued until 1 second after Aircraft A and Aircraft B collided, Tower East did not recognize the displayed warning (2.7.7(3), 2.7.7(4) and Attachment 1).

(7) When the accident occurred, at Tokyo Airport Traffic Control Tower, there were no regulations stipulating how to handle the situation when the warning by the Runway Occupancy Monitoring Support System was issued and no trainings based on the curriculum were conducted (2.7.7(2)).

(8) Warnings of the Runway Occupancy Monitoring Support System were visual ones (2.7.7(1)).

3.4 Direction of Analysis Regarding Aircraft B

3.4.1 Regarding the Fact that Aircraft B did not Recognize Aircraft A, which was Stopped on the Runway, until just before the Collision

Based on the statements of the flight crew members of Aircraft B and the factual information below, it is highly probable that the flight crew of Aircraft B did not recognize Aircraft A, which held on the runway, until just before the collision.

- Aircraft B did not abort the final approach and did not go around (2.1.2.3 (2)).
- There were no conversations between the flight crew members in the cockpit at or below 500 ft (Appendix 1).

3.4.2 Regarding the Fact that the Flight Crew of Aircraft B did not Recognize Aircraft A

Regarding the fact that Aircraft B did not recognize Aircraft A, which held on the runway until just before the collision, the following events may be involved, and further analysis is required, taking into account the results of the verification of the visibility of the DHC-8-315 aircraft's exterior lights and the results of the verification using the A350 simulator.

(1) When the accident occurred, it was past the time of, civil twilight after sunset and the moon had not yet risen (2.8.3).

(2) Based on the circumstances at the time of the accident, due to the aircraft structure, the only external lights of Aircraft A that could be seen from the rear were the anti-collision light (white strobe) and lower tail light position light (white) attached to the

tail of the fuselage, and the upper tail light position light (white) attached to the top of the vertical stabilizer (2.18.1).

(3) The runway centerline lights (white) and runway touchdown zone lights (white) embedded in the runway surface were illuminated around the area where Aircraft A was stopped (2.9.3).

(4) Aircraft B had been cleared to land (2.1.2.3(2)).

(5) An in-house trainee for first officer qualification was flying in the right seat, and PIC B was supervising him in the left seat (2.1.2.3(1)).

(6) During the final approach, until the aircraft reached an altitude of approximately 500 feet, there was a discrepancy between the wind reported by the Tower East and the wind direction on board the aircraft, so the flight crew predicted a change in wind direction during final approach and were concerned about the sudden change in speed that would result from this (2.1.2.3(2)).

(7) During the final approach before the accident, the safety pilot was monitoring communications with air traffic control agencies and flight parameters, in accordance with his assigned role, including monitoring Runway 34R (2.1.2.3(2) and 2.19.2.2).

(8) PIC B and Training Crew were using the HUD at all times, including during the final approach (2.1.2.3(2) and 2.19.2.1).

(9) While the flight crew was listening to air traffic control communications, there was no communication indicating concern about other aircraft making a wrong incursion into the runway regarding the use of Runway 34R (Appendix 1).

3.5 Damage of Aircraft B Caused by the Collision

The circumstances of the collision between Aircraft A and Aircraft B and the damage to the aircraft are as described in Chapter 2 as factual information based on on-site investigations and analysis of the aircraft systems.

The impact that occurred in this accident may have far exceeded the assumptions of the design standards for ensuring safety for both aircraft. Although there was no major damage to the cockpit or passenger cabin of Aircraft B, it is considered possible that the human casualties could have been greater if various conditions had been different. Therefore, in light of the fact that an emergency evacuation became necessary after the aircraft stopped, it is necessary to continue analysis, focusing on the points listed below, from the perspective of mitigating damage.

(1) After the collision between the two aircraft, there was no major damage to the cockpit and passenger cabin of Aircraft B, but the avionics compartment under the floor was destroyed, causing serious damage to the electrical system, flight control system, brake system and others (2.14.4.2 (1), (3), (4), (5)).

(2) After the collision, the emergency lights in the cabin were on, but the intercom was inoperable, and other equipment to be used by PIC B to issue emergency evacuation instructions or make in-flight announcements were also unavailable (2.14.4.3 (3)).

(3) Both engines continued to rotate until the impact brought the aircraft to a stop, after which the left engine shut down but the right engine did not (2.14.4.2 (6) and 2.14.4.3(4)).

(4) The FDR of Aircraft B stopped recording approximately 1.9 seconds after the collision between the two aircraft (2.14.4.1).

(5) Most aircraft structure of Aircraft B burned off by the fire was made of CFRP structural members (2.6.2 (5)).

3.6 Emergency Evacuation from Aircraft B

The emergency evacuation from Aircraft B is as described in Chapter 2 as factual information. In this accident, no serious injuries were reported during the emergency evacuation, however, in order to learn the lessons for future emergency evacuation, the events to be confirmed in relation to the emergency evacuation are described in 3.6.1 and the events considered to have contributed to the absence of serious human injuries are described in 3.6.2. Details will be confirmed, respectively.

3.6.1 Events to Be Confirmed in Relation to Emergency Evacuation

(1) The emergency evacuation of Aircraft B was carried out with the right engine still running, even though the flight crew members of Aircraft B had shut down the engines before initiating the emergency evacuation (2.1.3).

(2) The exits used for the emergency evacuation were Exits L1, R1 and L4 (2.1.3).

(3) As the Emergency Evacuation Command (EVAC CMD) and Passenger Address (PA) systems were not available from the cockpit, PIC B's evacuation instructions were initially communicated to the Crew in Charge and the cabin crew members in charge of Exits L1 and R1 by voice only, without PA system (2.1.3).

(4) Following PIC B's instructions, the cabin crew members in charge of Exits L1 and R1 opened the doors early and began the emergency evacuation (2.1.3).

(5) As the instructions to begin the emergency evacuation could not be given in one go, crew members moved around the cabin giving evacuation instructions and directing most passengers to the front exits (2.1.3).

(6) Although some crew members used megaphones, instructions to passengers were given almost by voice only (2.1.3).

(7) The cabin crew member in charge of L4 had not been able to receive any information from PIC B or other crew members that the evacuation had begun through the forward exits, and as the smoke situation around there was becoming more threatening, the cabin crewmember in charge of Exit L4 independently confirmed the situation outside, opened the door, and began the emergency evacuation (2.1.3).

(8) Some passengers were unable to recognize instructions from the crew members and followed the movements of the passengers around them who were moving forward to evacuate, while others remained near their seats (2.1.3).

(9) Passengers who remained near their seats did not realize that the emergency evacuation had begun, and followed the instructions given by the crew immediately after the aircraft came to a halt (to stay low and near their seats to avoid smoke) and waited for further instructions from the crew (2.1.3).

(10) Passengers, who had remained near their own seats, were discovered by crew members who were checking to see if any passengers had been left behind and evacuated.

(11) Regarding Exits L2, L3, R2, R3 and R4, which were not used for the emergency evacuation, the cabin crewmembers in charge of each exit decided not to use them because they had confirmed that there was a fire outside, and they remained at their assigned exits to monitor them to ensure that passengers trying to escape would not open the door accidentally. The decision not to use Exit R4 was also made because, in addition to the fire, they had seen sparks flying backwards (2.1.3)

(12). Some of the passengers who had evacuated from L4 were temporarily out of the control of the flight crew of Aircraft B and the airport manager. In addition, the number of passengers after the evacuation was not counted on-site, but rather moved to a waiting area inside the building, where they were counted (2.17.2).

3.6.2 Events that Possibly Contributed to the Absence of Serious Human Injuries during the Emergency Evacuation

(1) There was no damage to the aircraft structure of Aircraft B occurred in the cabin that would have hindered evacuation (2.14.4.2 (1)).

(2) After the collision, Aircraft B came to a halt in a grassy area without capsizing (2.1.2.3(2)).

(3) No serious injuries were caused by the impact of the collision (2.2.2).

(4) The cabin crew member reported the fire to PIC B immediately after Aircraft B stopped (2.1.3).

(5) Exits L2, L3, R2, R3 and R4 were not used for emergency evacuation (2.1.3).

(6) Most passengers were evacuated from Exits L1 and R1, which had gentler slopes (2.1.3).

(7) The cabin attendant at L4, whose escape slide had a steep slope, instructed passengers to "sit down and slide" during the emergency evacuation (2.17.2).

(8) There was about 10 minutes before the fire in Aircraft B caused by the collision to spread to the cabin (2.16.1(1)).

(9) As the passengers followed the cabin crew members' instructions, the situation of passengers rushing into the aisles or exits to escape did not occur (or continue) (2.1.3).

(10) In a situation where the PA system and others was not available, PIC B and the chief of cabin crew members instructed the emergency evacuation while moving around the cabin (2.1.3).

(11) The crew members searched for passengers remaining on board Aircraft B and encouraged passengers who had remained near their own seats to evacuate (2.1.3).

(12) During the emergency evacuation, the fire did not spread to the areas around the landing points of the slides of the L1, R1 and L4 used for the evacuation (2.17.1(2)).

(13) The crew members of Aircraft B had attended regular rescue training conducted by the operating company within one year prior to the accident and had received training in emergency evacuation (2.5.2).

3.7 Firefighting and Rescue Operations

After the accident occurred, firefighting activities were carried out on both aircraft, a search was conducted for the crew of Aircraft A, and the passengers and crew who had made an emergency evacuation from Aircraft B were protected and guided. These activities are described in Chapter 2, but further analysis is required to derive lessons from the perspective of reducing damage with regard to the following matters.

3.7.1 Firefighting and Search

(1) Firefighting operations for the fires that broke out on both aircraft immediately after the accident were initially conducted by the Airport Fire Station, with three fire engines dispatched to each fire site (2.16.2 (1)).

(2) The search for the crew members of Aircraft A was conducted by the Airport Fire Station brigade members, SRT members, and firefighters from the Tokyo Fire Department, who were the first to arrive at the scene (2.1.2.1 and 2.17.1).

(3) When the airport fire engines arrived at Aircraft B, the passengers were in the process of being evacuated (2.16.2(1)).

(4) Until the evacuation of the passengers from Aircraft B was completed, firefighting efforts on Aircraft B were focused on cooling the fuselage to give priority to allowing time for passengers to evacuate (2.16.2(1)).

(5) The Airport Fire Station brigade members and firefighters from the Tokyo Fire Department who were involved in extinguishing the fire on Aircraft B did not know that CFRP was burning, therefore no dust prevention measures were taken (2.16.2 (1) and (2)).

(6) Because the firefighting efforts continued for a long time, the fire engines needed water, and in consideration of water supply efficiency, water was supplied to the fire engines at the fire station building multiple times (2.16.2 (1)).

(7) Due to the intensity of the fire on Aircraft B, two of the fire engines originally assigned to Aircraft A were reassigned to Aircraft B when the fire on Aircraft A diminished (2.16.2 (1)).

(8) After 20:20, some airport's fire engines were successively put on standby in preparation for the resumption of operations on other runways (2.16.2 (1)).

(9) At the request of the Airport Fire Station, the Tokyo Fire Department conducted firefighting operations and a search for missing persons (2.16.2 (2)).

(10) The Tokyo Fire Department fire engines waited for a guide vehicle at the emergency gate to enter the airport's restricted area, but when they arrived at d Aircraft B, the fire had spread throughout the entire fuselage of Aircraft B (2.16.2 (2)).

(11) Seawater was used in firefighting by the Tokyo Fire Department (2.16.2(3)).

3.7.2 Guiding Passengers after the Emergency Evacuation

(1) A firefighting and rescue cooperation team was organized to evacuate the passengers onboard Aircraft B and direct them away (2.17.3).

(2) Passengers who had evacuated from Aircraft B stayed in the vicinity of Aircraft B, so the firefighters on board the fire engines directed the passengers away from Aircraft B, and the evacuated crew members also directed the passengers away from Aircraft B (2.16.2 (1)).

(3) A fire engine, which had left the site to supply water, directed the passengers, who had evacuated from the accident site, to a collection point for buses (2.16.2 (1)).

(4) The 18 passengers who evacuated from Exit L4 were found on their way to Terminal 2 by an employee of another airline working in a nearby parking spot, who directed them to the bus meeting point (2.17.2).

(5) Among the passengers who escaped from L4 were two employees of the group company, who contacted company officials and, following their instructions, guided the passengers toward Terminal 2 (2.17.2).

(6) Two employees of the group company who were among the passengers, who evacuated from L4, had received training on emergency evacuation response for ground staff based on the safety measures taken by the company as a response to the emergency evacuation accident that occurred at New Chitose Airport on February 23, 2016, and based on their experience in the training, they gave instructions to passengers around their seats in order to assist the cabin crew after the aircraft came to a halt (2.17.2).

3.7.3 Responses Taken by the Airport Office

(1) Based on the plan for responding to an aircraft accident at the airport, the airport office established a local response headquarters, a local joint response headquarters, and an on-site command post, and also organized a firefighting and rescue cooperation team (2.17.3).

(2) Runways A, B and D resumed operations before the completion of firefighting efforts on the accident aircraft on Runway C (2.11.2).

3.7.4 Safety Issues Identified during Firefighting and Rescue Operations

(1) Dust Control of CFRP Combustion Residue

The airport firefighters and Tokyo Fire Department firefighters who were involved in the firefighting activities were not aware of the danger of dust generated from CFRP combustion residues. In addition, although the Japan Transport Safety Board had educated air accident investigators about the danger of dust generated from CFRP combustion residues at the fire scene of Aircraft B, which used CFRP, personal equipment for dust protection was not fully equipped, and the investigators who entered the scene on the day of the accident did not take sufficient dust protection measures. Following a point made by the French accident investigation authorities who joined the on-site investigation the following day, dust protection measures were taken in subsequent investigations of the wreckage of Aircraft B.

In the future, it will be necessary to provide those involved in firefighting activities and wreckage disposal work in the event of a fire on an aircraft that uses CFRP with information about the effects on the human body of dust generated from CFRP combustion residues and to take measures to protect against this dust in advance.

3.8 Other Safety-Related Issues that Have Come to Light

3.8.1 FDR Recording Malfunction on Aircraft A

As described in 2.12.1, the throttle lever position, a parameter that should be recorded, was not recorded properly in the FDR of Aircraft A. In addition, as described in 2.12.4, some of the parameters that should be recorded, like Aircraft A, were not recorded properly in some of the Agency's DHC-8-315 aircraft other than Aircraft A.

If parameters that should be recorded in the FDR are not recorded properly during an accident investigation, there will be a lack of objective data on the state of the aircraft, the pilot's operation, or the aircraft's surrounding environment at the time of the accident, which will affect scientific analysis.

In order to smoothly conduct investigations in the event of an accident, accurately identify the cause, and propose effective measures to prevent recurrence, it is necessary for all flight recorders, including FDRs, to record properly.

3.9 Standpoint of This Interim Report

The purpose of accident investigations is to determine the cause, prevent the recurrence of similar accidents, and reduce the damage caused by accidents. The investigation report describes the results of the investigation, but in order to protect the parties who in good faith provided information for the investigation, the factual information recorded is limited to safety-related information consistent with the purpose of the investigation.

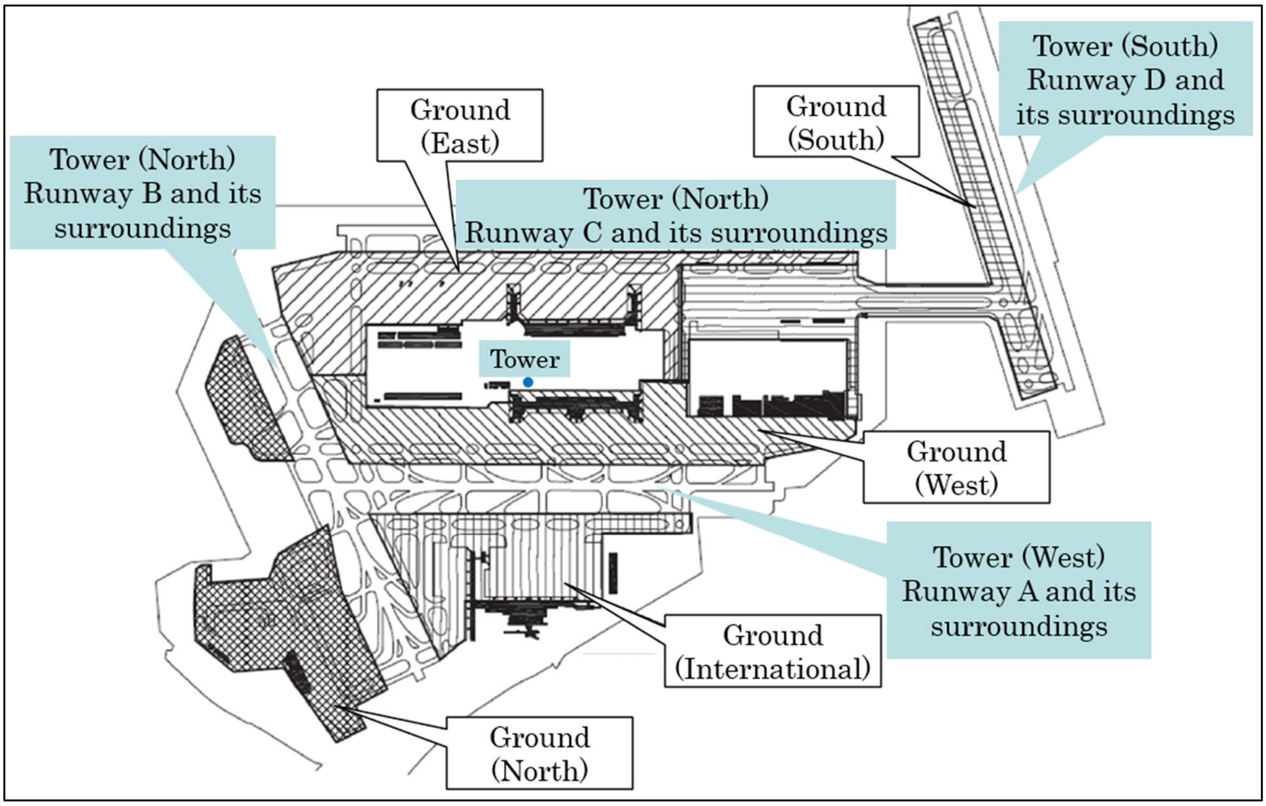
This interim report contains many factual pieces of information that may have been involved in the accident, but further analysis is required to determine the relationship between this information and the cause of the accident, and the damage caused by the accident. However, bas this factual information is recognized as safety related, it has been decided to make it public at an early stage in this interim report. It is hoped that this will enable many people involved in the aviation industry to come into contact with this safety-related information and use it to improve the safety of their own flights.

Attached Figure 1　Tokyo International Airport

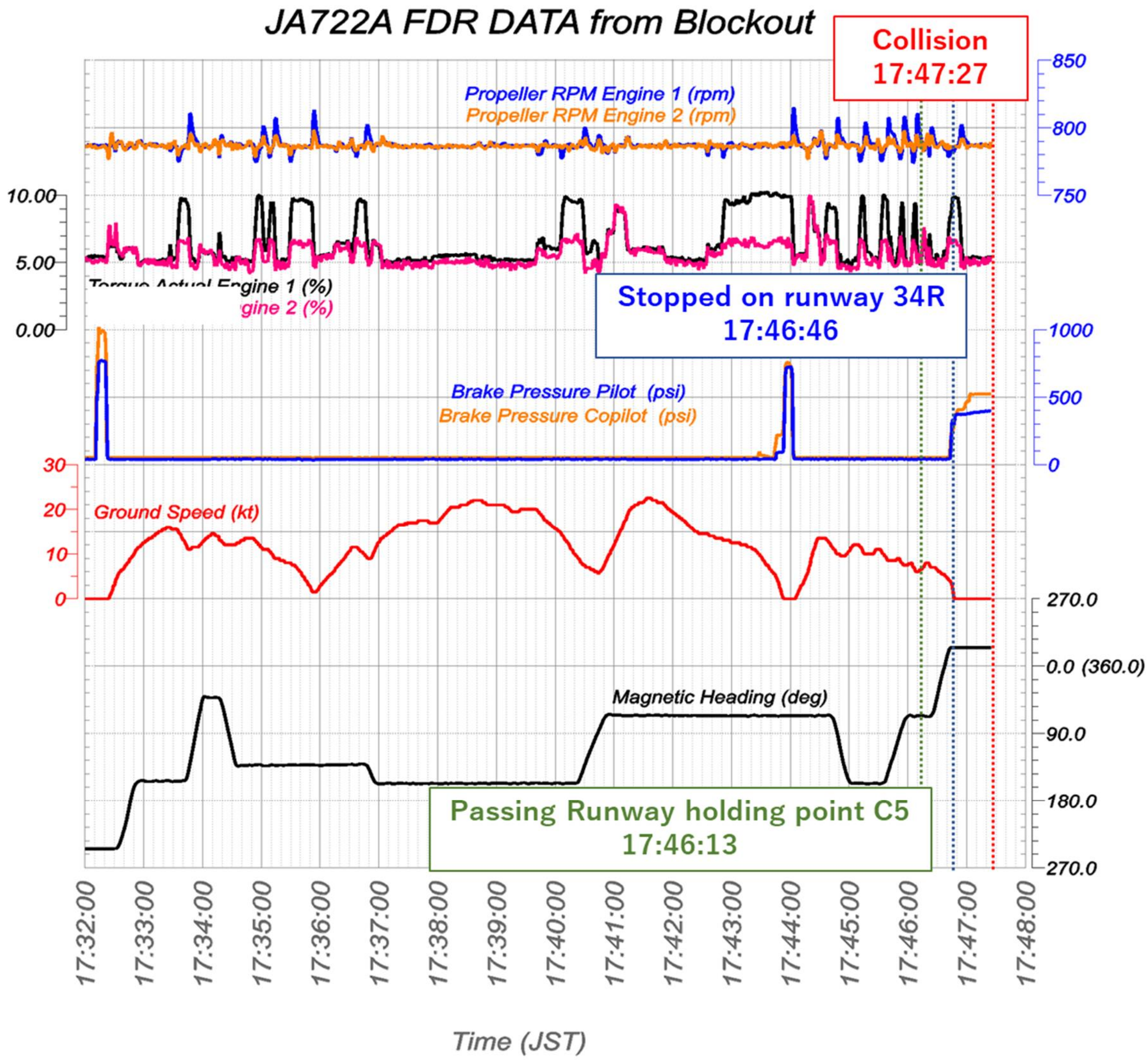
Attached Chart: Control Positions Composed Tokyo Airport Control Tower and Their Main Duties

Control Positions	Abbreviation	Duties
Supervisor	TW	· Completing and preparing documents for Tokyo Airport Control Tower · Coordination regarding maintenance of equipment, etc. · Coordination of liaison regarding diversions, flight inspections, special flights, VIP flights, etc. · Liaison and coordination with relevant agencies in the event of a disruption to runway or taxiway operations · Liaison and coordination with relevant agencies in the event of an emergency or hijacking · Input of runway information related to air traffic control equipment · Regarding combining of air traffic control positions
Tower Coordination	TC	· Coordination between relevant control positions in Tokyo Airport Control Tower regarding arrival and departure aircraft and aircraft passing through the control zone · Coordination with Tokyo Radar Approach Control Facility (AFS, OA) regarding landing intervals of arrival aircraft
Flight Monitor	FM	· Monitoring to radio communications and coordination with the related control positions conducted by the Tower Position · Advise or confirm with the tower position regarding the content of the monitoring · Monitoring the movements of aircraft under the control of the tower position * As a general rule, when Runway 34 is in use, FM will be staffed at the tower position (West)
Tower (East/West/South/ North)	LCL	· Issuing ATC permission, instructions, or information to aircraft taking off and landing on the runway and aircraft flying in the vicinity · Coordination with Tokyo Radar Approach Control Facility (DF) regarding the go-around aircraft * The jurisdiction of the tower positions is as shown in Attached Figure 2
Ground (East/West/ South/North/ International)	GND	· Issuing ATC permission, instructions, or information regarding ground movement of aircraft and vehicles in the area under its jurisdiction (are for ground movement of aircraft excluding aprons) · Issuing ATC permission, instructions, and liaison and coordination for those engaged in work within the restricted areas of airport under their jurisdiction * The jurisdiction of the ground positions is as shown in Attached Figure 2
Clearance Delivery (A/B)	CD	· Relay approved flight routes, altitude, etc. to aircraft flying under instrument flight rules
Fight Data (East/West)	FD	· Liaison and coordination with relevant facilities and control positions and relay of information, etc.

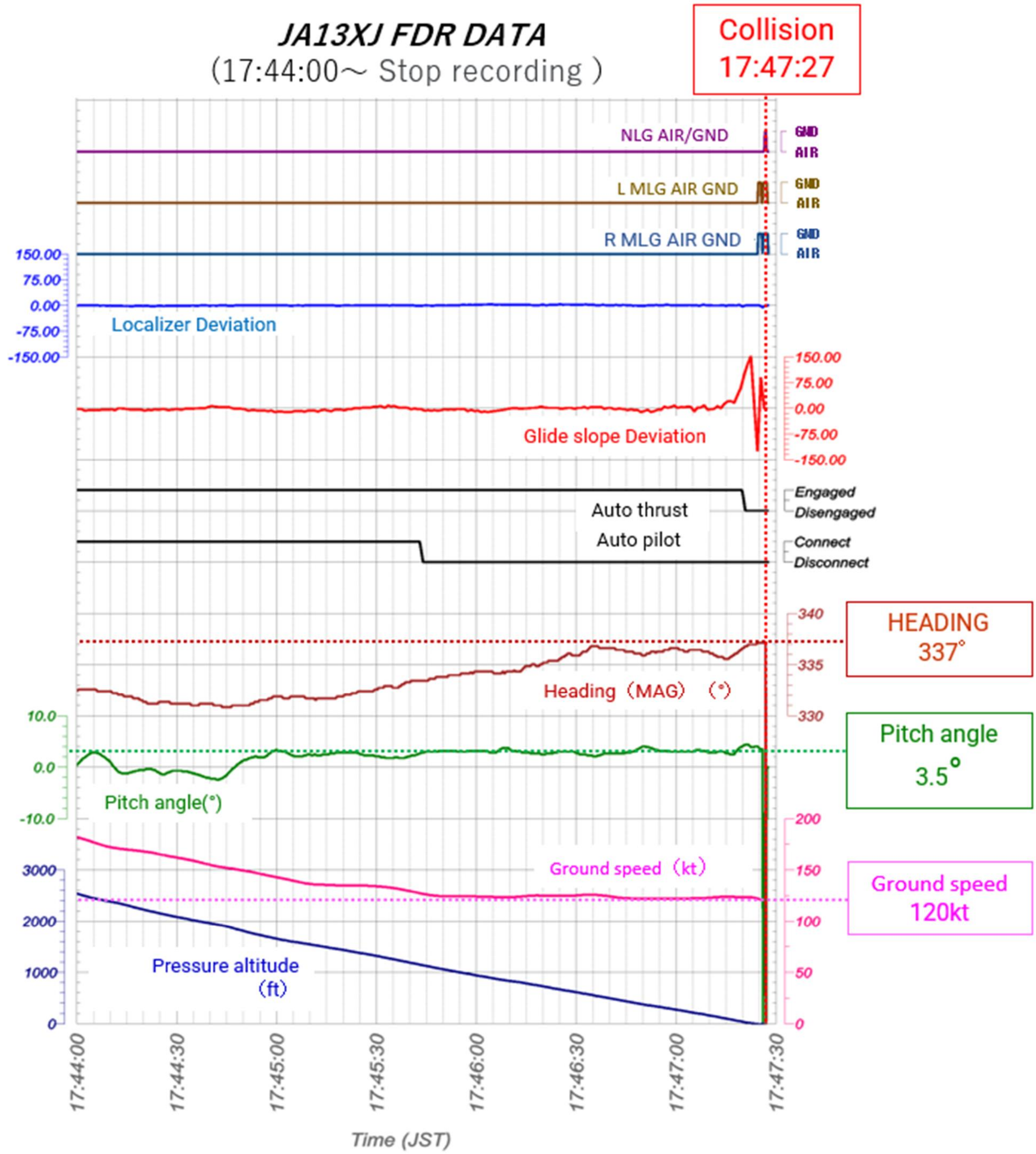
Attached Figure 2:
Airport diagram of Tokyo International Airport (Haneda Airport) with jurisdictions of Tower control positions and Ground control positions



Attached Figure 3: Data recorded in Aircraft A's FDR



Attached Figure 4: Data recorded in Aircraft B's FDR



Attached Figure 5:

Three-angle view of Bombardier DHC-8-315

Unit: m

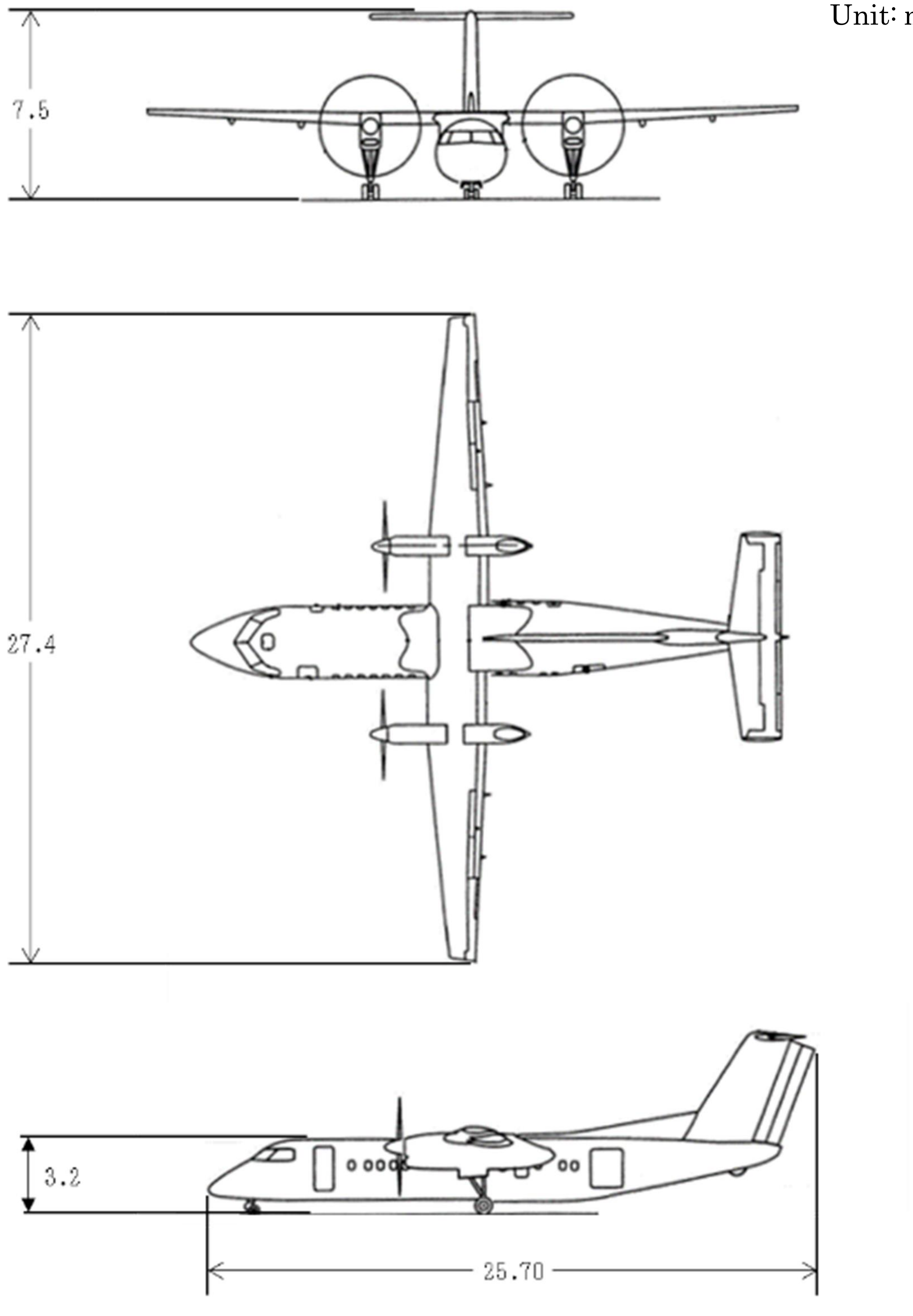
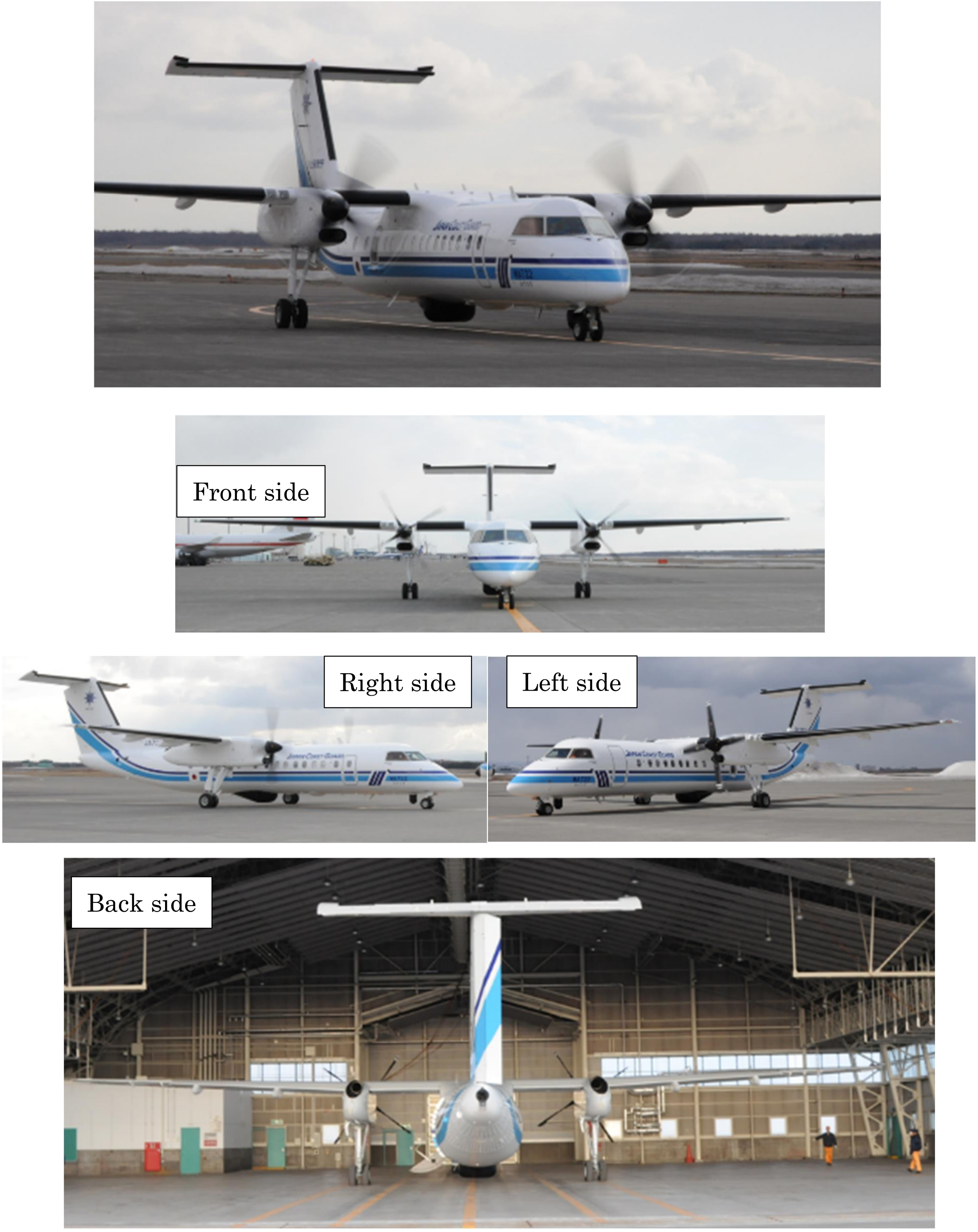
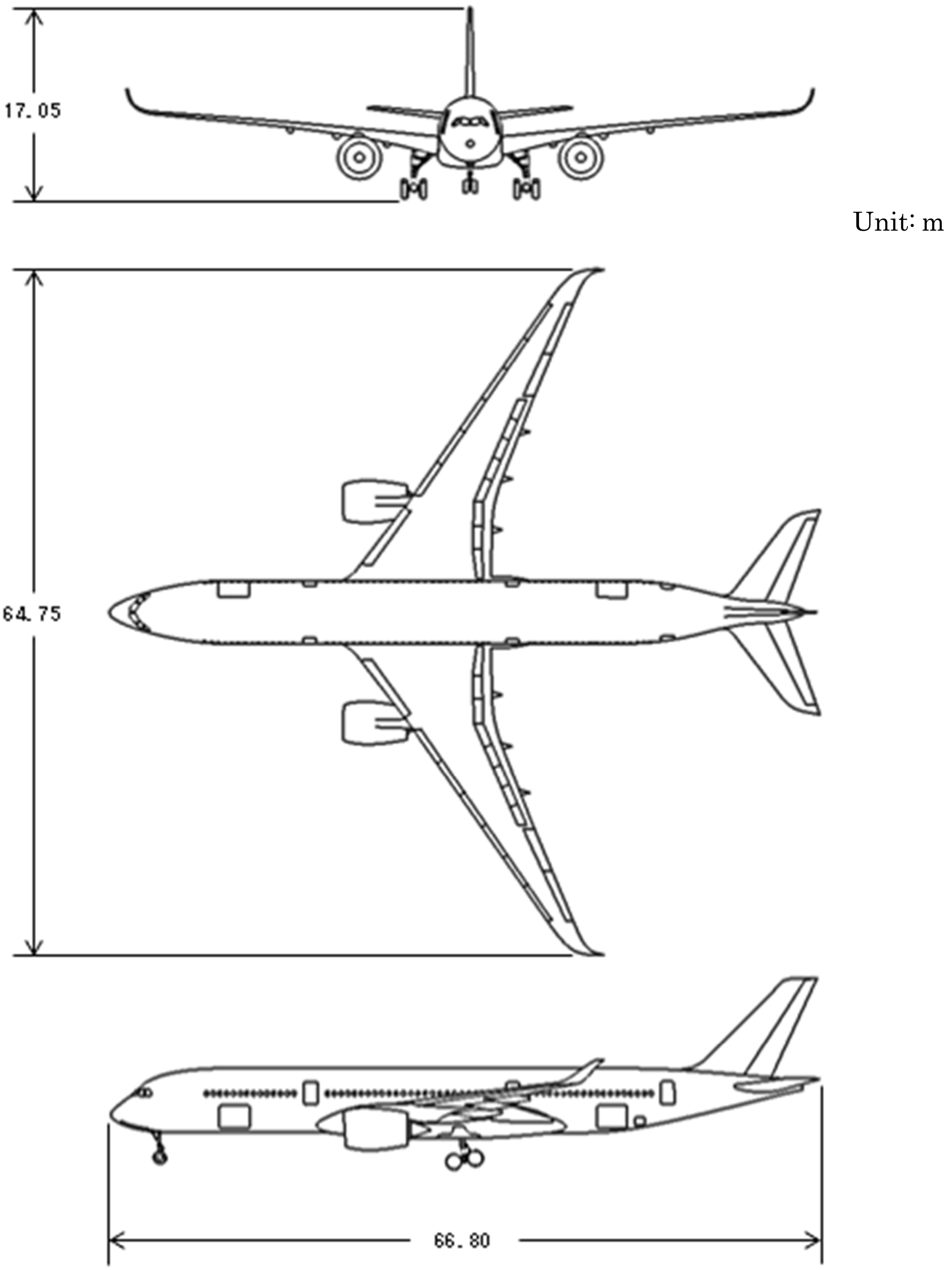


Photo 1: Aircraft A



Attached Figure 6: Three-angle view of Airbus A350-941



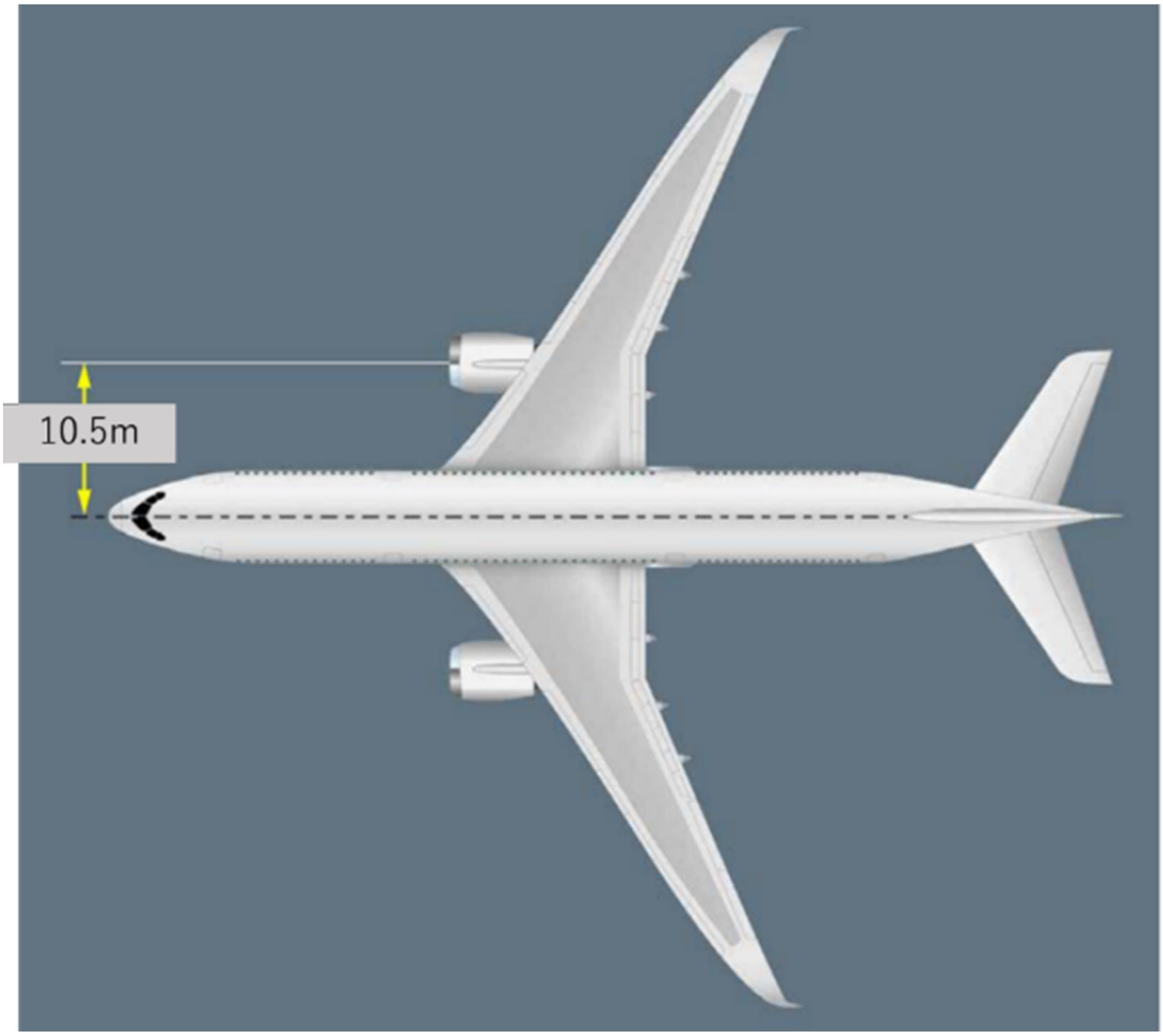
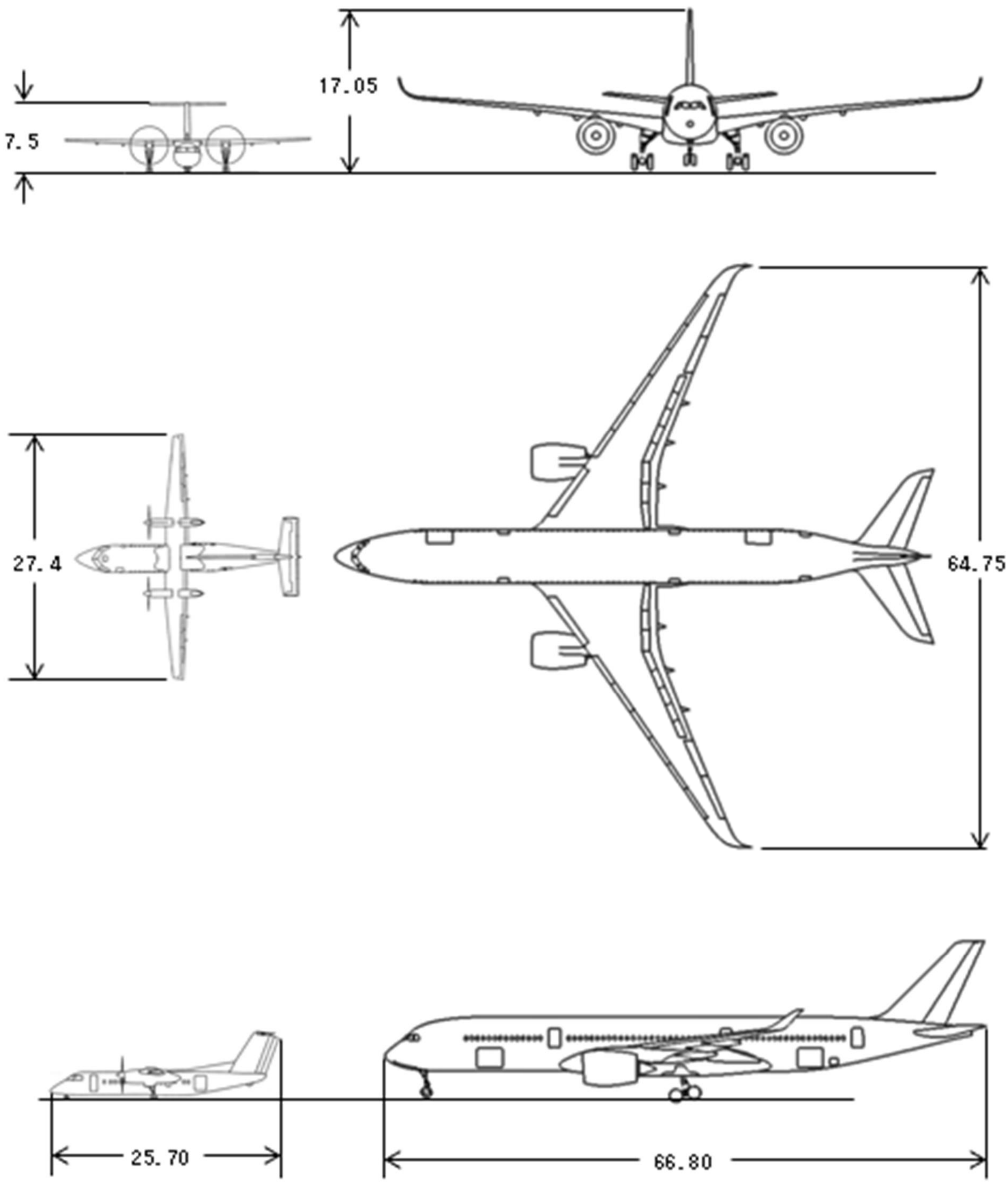

10.5m

Photo: Airbus A350-941 (Same type of Aircraft B)

Attached Figure 7:

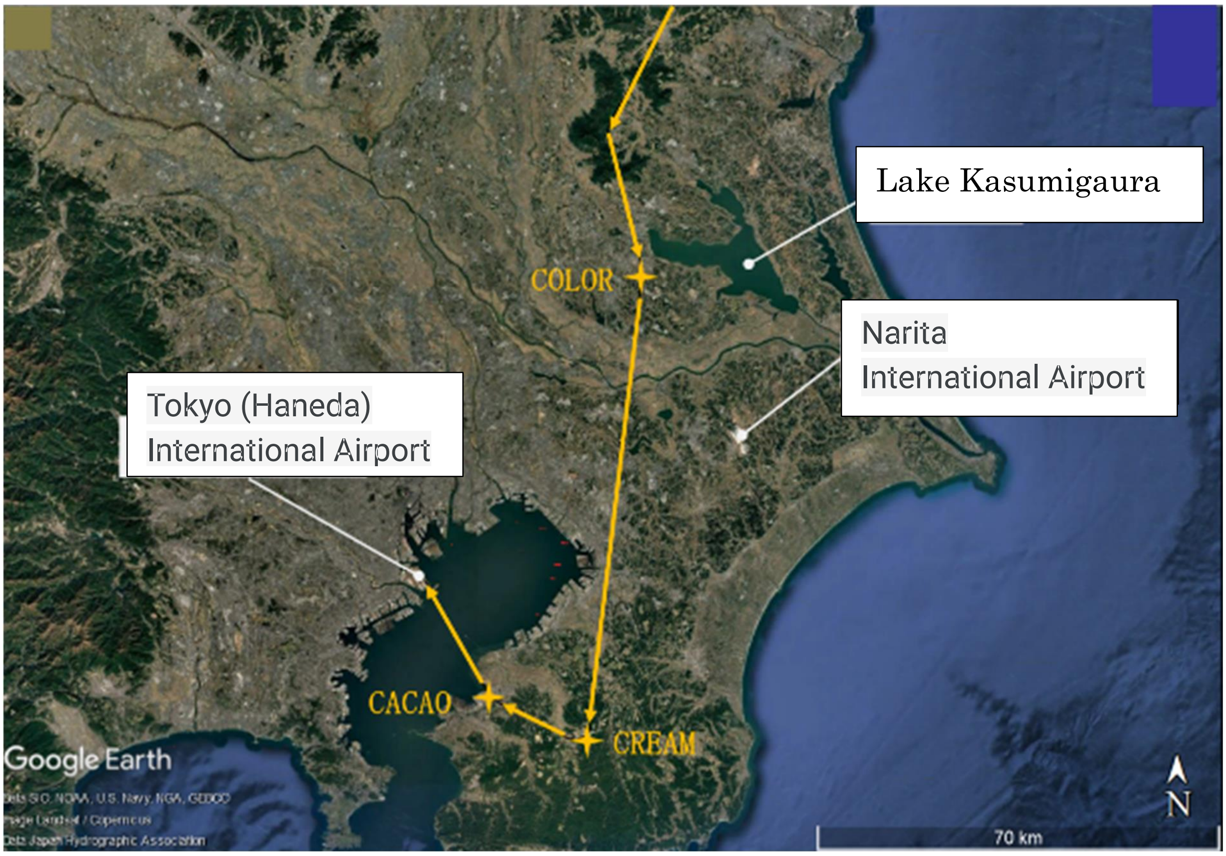
Bombardier DHC-8-315 and Airbus A350-941 three-view drawings



Unit: m

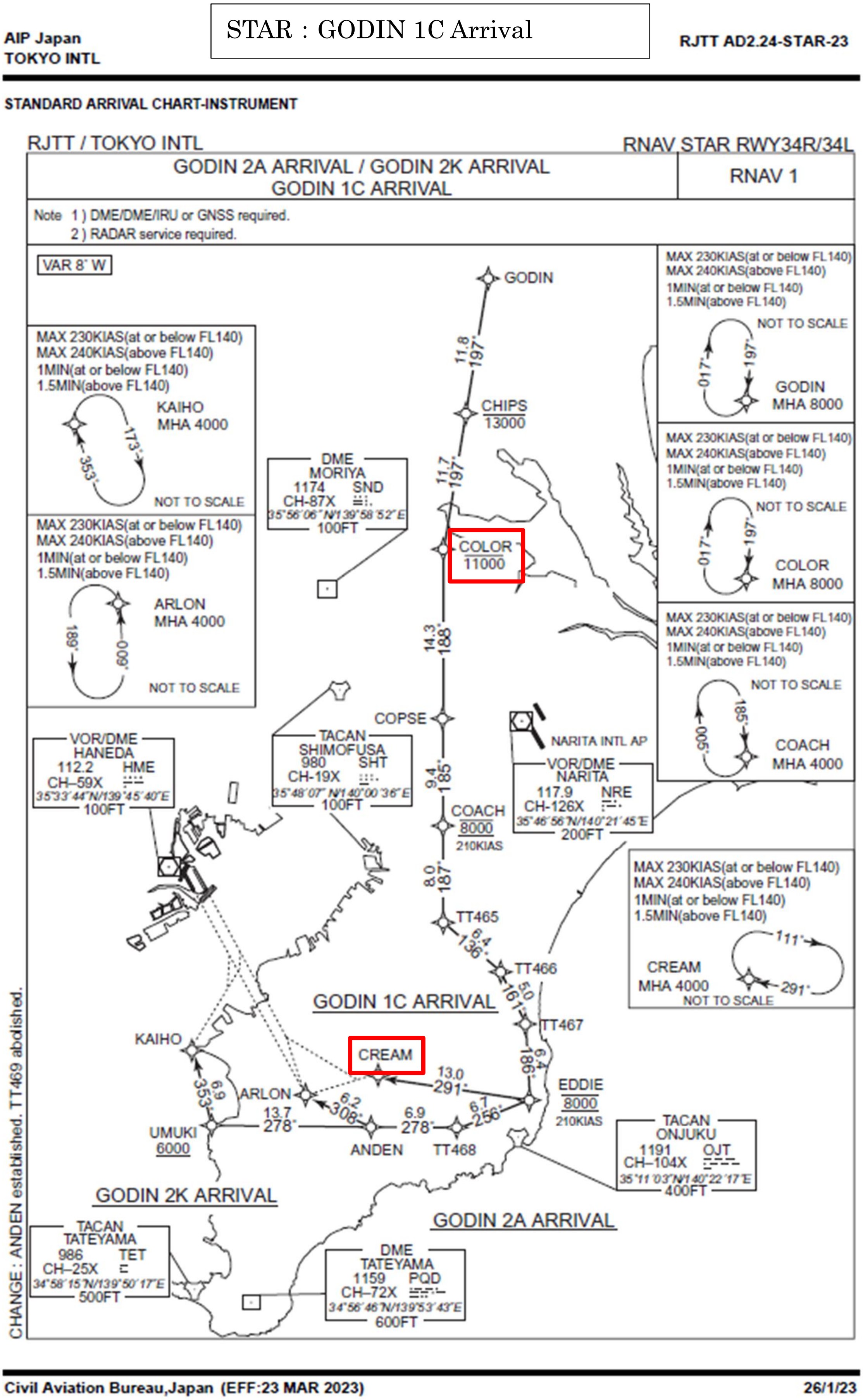
Attached Figure 8: Flight route of Aircraft B

(from 17:25 onward)



Attached Figure 9: The assigned arrival route and approach procedure of Aircraft B

STAR : GODIN 1C Arrival



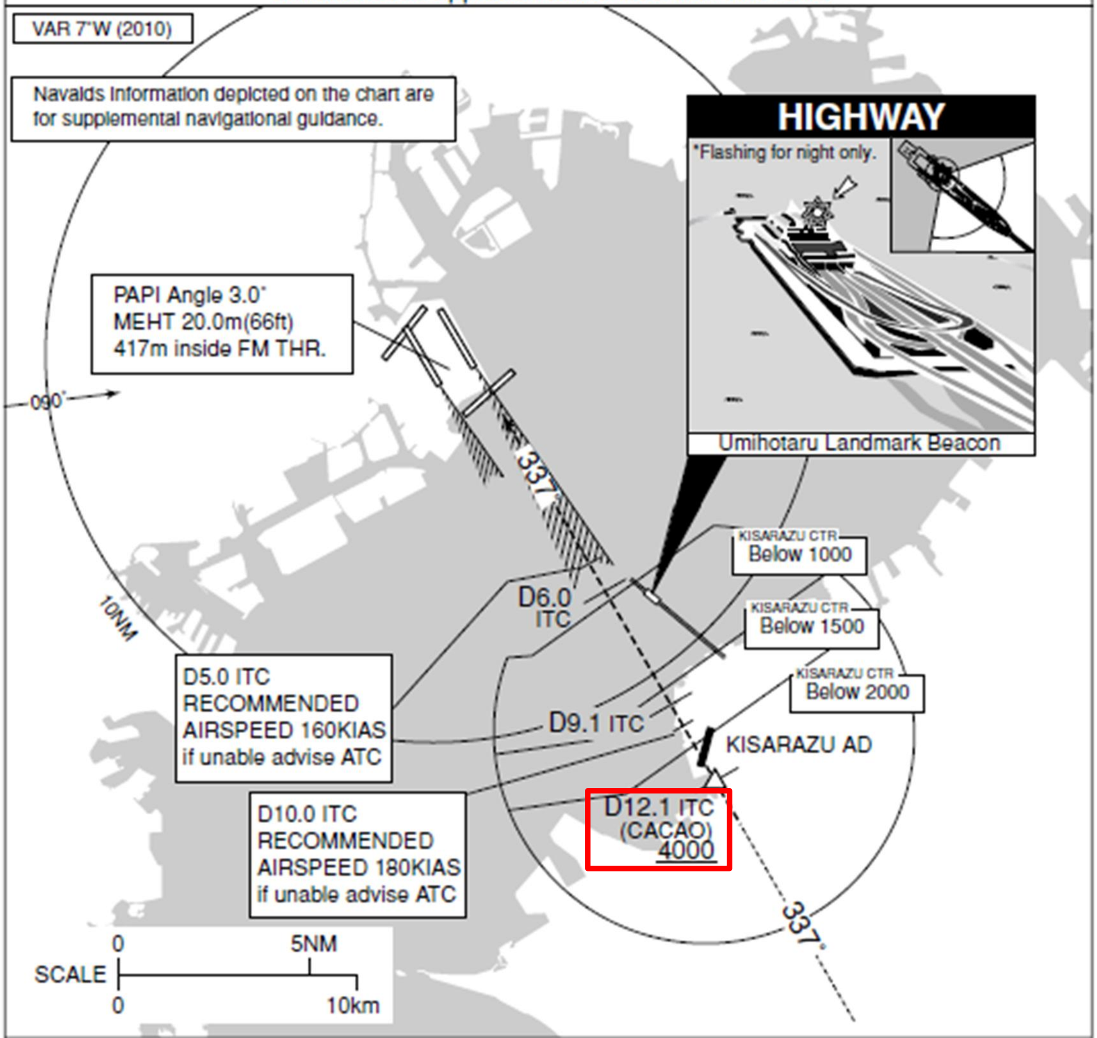
APR：HIGHWAY VISUAL Approach

VISUAL APPROACH
HIGHWAY VISUAL RWY34R

RJTT / TOKYO INTL

TOKYO APP	ILS – LOC	TOKYO TOWER	
119.1 - 119.4 - 119.7 126.5 - 236.8 - 261.2	ITC 108.9 ILS–GP 329.3	124.35 - 118.1 - 118.575 118.725 - 118.8	ATIS 128.8

Simultaneous approach authorized with RWY34L



When visual approaches to RWY34R are in progress, arriving aircraft may be vectored to CACAO for HIGHWAY VISUAL RWY34R APPROACH.
In the event of a go-around, climb via ITC LOC and after THR HDG030° to 3000FT until receiving ATC instructions.

<HIGHWAY VISUAL RWY34R APPROACH>
After CACAO, aircraft proceed to RWY34R (ITC LOC course).
For avoid entering KISARAZU CTR, aircraft is recommended ITC 9.1DME at or above 2500FT, ITC 6.0DME at or above 1500FT.

Note1: Pilot is urged to report promptly to ATC when lose sight of landmark(HIGHWAY) and the preceding aircraft concerned.
Note2: Reference NAVAIDS(ITC LOC) must be operating.
Note3: RADAR service required.
Note4: Procedure not authorized at night in case of Umihotaru Landmark Beacon not operated.
Note5: When cleared HIGHWAY VISUAL RWY34R APPROACH, aircraft should fly via last routing cleared until CACAO.

Appendix 1: Inside the Cockpit of Aircraft A and B

1 Aircraft A

From the CVR records and ATC communication records, the following is a description of the inside of the cockpit. The conversations quoted below are extracted from the relevant portions of the CVR records.

Spot N957

17:25:39	Aircraft A in Spot N957 requested the Clearance Delivery controller of Tokyo Aerodrome Control Facility (hereinafter referred to as "the Tokyo Delivery") for a clearance.
17:27:21	Tokyo Delivery issued a clearance for Aircraft A.
17:28:37	FO A read back the clearance, but there was no confirmation of FO A 's readback by PIC A.
Around 17:29	PIC A anticipated the takeoff Runway to be Runway 34R and conducted a takeoff briefing.
17:29:06	FO A decided to set the FMS*[50] set as Runway 05 to Runway 34R and asked PIC A for PIC A 's approval, to which PIC A said, "Sure".
17:30:32	PIC A stuttered during the last item of the takeoff briefing, the ENG Failure After V1, which occurred after the takeoff decision speed. FO A replied, "I understand," and the takeoff briefing by PIC A ended, although it was in the middle of the takeoff briefing.
17:31:02	Aircraft A contacted with the Ground international controller of Tokyo Aerodrome Control Facility (hereinafter referred to as "Ground international").
17:31:16	Ground International instructed Aircraft A to taxi by designating taxi routes (taxiway N5, taxiway N, Taxiway N7, and runway holding point T7) toward Runway 34R.
17:31:26	PIC A read back, "N5, N, N7, holding point T7.
17:31:30	PIC A confirmed by saying, "N7, holding point T7".
Around 17:32	Aircraft A began taxiing to Runway 34R.

Taxiways N5, N, N7, T7

Around 17:35	PIC A and FO A mutually confirmed that they had received instructions to taxi to T7.
17:35:36	Aircraft A 's communication was transferred from Ground International to Tower West on Taxiway T7 for Runway 04 crossing.

*50 "FMS" is an abbreviation of Flight Management System, which assists crew members with navigation, performance, fuel monitoring and display in cockpit

17:35:45	Aircraft A set up communications with Tower West, was cleared to cross Runway 04, and communications were transferred from Tower West to Ground International.
17:35:56	FO A read back, "Cross Runway 04 contact 12162 again.

Runway 04

Around 17:36	FO A called out, "Final, runway, clear" on the Runway 04 crossing with a safety check of the final approach course and runway right. PIC A said, "Yes".
17:36:13	FO A communicated with Ground International and advised that they were crossing Runway 04.
17:36:16	Ground International indicated a taxi route (via Taxiway L to holding point L4).
17:36:21	FO A read back, "L, L4.
17:36:42	PIC A instructed FO A to turn the anti-collision lights, which had been set to white, to red when crossing the runway.
17:36:48	PIC A confirmed by saying, "L, L4".

Taxiway L, Taxiway L4

17:39:19	Aircraft A was a communications transfer from Ground International to Tower West.
17:39:34	Aircraft A communicated with Tower West and said it was taxing toward taxiway.
17:39:38	Tower West was instructed to hold short of Runway 34L.
17:39:43	FO A read back, "Hold short of Runway 34L, L4."
17:39:47	PIC A confirmed by saying, "Yes, hold short of Runway 34L".
Around 17:40	PIC A and FO A mutually confirmed to hold short of Runway 34L at L4.
17:40:45	Tower West cleared Aircraft A to cross Runway 34L and indicated the subsequent taxi route (Taxiway H).
17:40:49	FO A read back, "Cross Runway 34L via H."

Runway 34L

17:40:53	PIC A had FO A perform a safety check on the right side of the runway and left side of the runway.
17:40:57	PIC A said, "Cross, final," and FO A said, "Yes."
Around 17:41 分	PIC A said, "H, straight," and FO A said, "Straight," and PIC A said, "Yes".

Taxiway H

17:41:31	Aircraft A 's communication was transferred from Tower West to Ground East.
17:42:26	Plane A communicated with Ground East.
17:42:29	Ground East instructed Aircraft A to hold short of Taxiway

	C. 17:42:34 FO A read back, “Hold short of C.”
17:42:37	PIC A said, “Yes”.
17:42:38	PIC A confirmed by saying, “Hold short of C”.
17:42:39	FO A said, “Hold short”.

Before Taxiway C

17:43:07	PIC A said, “One right and one left.
17:43:08	FO A said, “Yes, collect.
17:43:10	PIC A said, “Yes”.
17:43:34	PIC A said, “Solaseed Air on the left”.
17:43:35	FO A said, “Yes”.
17:43:36	PIC A said, “Maybe this is… (unclear)”.
17:43:48	PIC A said, “Yes, we will stop”.
17:43:49	FO A said, “Yes”.
17:44:13	Ground East instructed the taxi route continue Taxiway C to holding point)”.
17:44:18	PIC A said, “Yes”.
17:44:19	FO A read back, “Continue C holding point”.

Taxiway C

17:44:21	PIC A said, “I will close the space”.
17:44:22	FO A said, “Yes, I got it”.
17:44:54	Aircraft A ‘s communication was transferred from Ground East to Tower East.
17:44:56	Tower East issued a clearance to land on Runway 34R for aircraft B.
17:45:10	Aircraft A communicated with Tower East and said that was on Taxiway C.
17:45:14	Tower East instructed, “JA722A Tokyo TWR, good evening. Number one, taxi to holding point C5”.
17:45:18	FO A read back, “To holding point C5, JA722A. Number one, thank you”.
17:45:21	PIC A said, “Number one” to cover FO A 's readback of Number one”.
17:45:22	PIC A confirmed by saying, “C5”.
17:45:23	PIC A said, “No problem”.
17:45:24	FO A said, “Yes, no problem!”.
17:45:25	PIC A instructed FO A to implement the Before Takeoff Checklist, saying, “Yes, well, Before Takeoff Checklist”.
Around 17:45:30	FO A initiated the Before Takeoff Checklist.
17:45:41	FO A said, “Anti-Collision, WHITE” according to the Before Takeoff Checklist and turns the anti-collision lights to white.

17:45:51	A call was made from Comm A to Aircraft A.
17:45:54	FO A said, "Dot Line" (indicating Checklist interruption).
17:45:58	PIC A instructed, "Gust Lock*[51] Off, Check Control*[52] .
17:45:59	FO A said, "Yes, Gust Lock Off".
17:46:05	FO A released Gust Lock, checked the Control Wheel movement, and said, "Checked".
17:46:08	PIC A said, "Yes".
17:46:11	FO A said, "IP*[53] is on, right?".
17:46:13	PIC A said, "Yes".

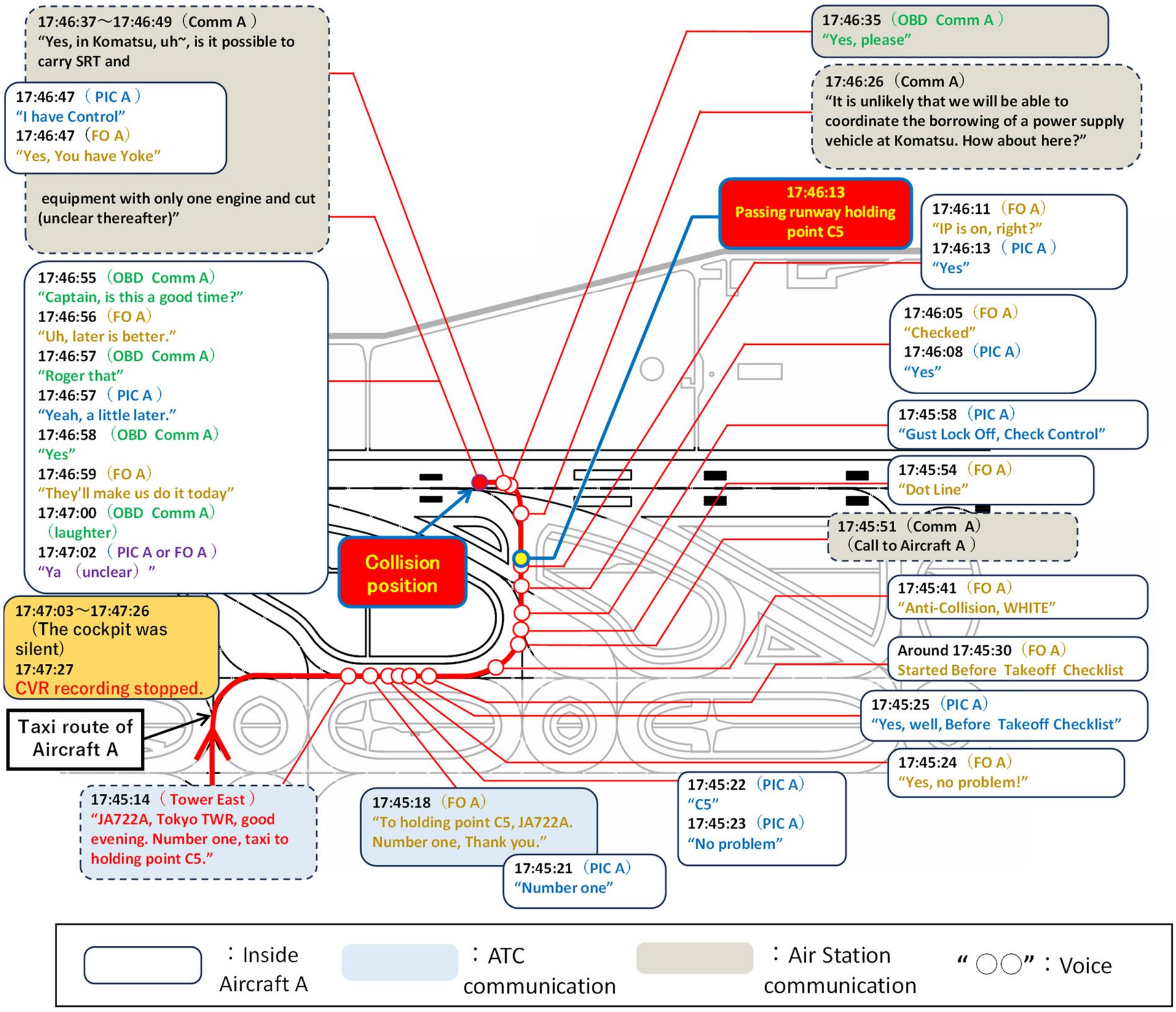
Passing Runway holding point C5 (17:46:13)

17:46:26	Comm A said, "It is unlikely that we will be able to coordinate the borrowing of a power supply vehicle at Komatsu. How about here?".
17:46:35	OBD Comm A said, "Yes, please" to Comm A.
17:46:37～49	Comm A said, "Yes, in Komatsu, uh~, is it possible to carry SRT and equipment with only one engine and cut (unclear thereafter) " .

Stopped on Runway 34R

17:46:47	PIC A said, "I have Control".
	FO A said, "Yes, you have Yoke".
17:46:55	OBD Comm A said, "Captain, is this a good time?"
17:46:56	FO A said, "Uh, later is better."
17:46:57	OBD Comm A said, "Roger that."
17:46:57	PIC A said, "Yeah, a little later."
17:46:58	OBD Comm A said, "Yes."
17:46:59	FO A said, "They'll make us do it today."
17:47:00	OBD Comm A (laughter)
17:47:02	PIC A or FO A said, "Ya (unclear)".
17:47:03～26	(The cockpit was silent.)
17:47:27	CVR recording stopped.

*51 "Gust Lock" means a locking mechanism on the control wheel to prevent damage to the control surfaces of a parked aircraft due to flapping of the control surfaces caused by a gust of wind.
*52 "Check Control," see 2.19.1.1(2) a.
*53 "IP" means ice protection device, see 2.19.1.1(2) c.



Taxi Route of Aircraft A after 17:45:14

2 Aircraft B

According to the CVR records and ATC communication records, the situation inside the cockpit of Aircraft B during final approach was as follows. The conversations quoted below are extracted from the relevant portions of the CVR records.

17:42:44	Aircraft B was instructed by Tokyo Terminal Control to establish communication with the East Tower, and the PM repeated this to Tokyo Terminal Control.
17:42:52	The PF made a call to check the autopilot status, etc., and the PM responded.
17:43:01	The PF ordered the PM to set up communication with Tower East.
17:43:05	Aircraft B was instructed by the East Tower to continue its approach to Runway 34R.
17:43:12	The PM repeated the ATC instructions.
17:43:15	The PF read back the ATC instructions, which the PM confirmed.
17:43:18	The PF set the altitude to 3,000 ft, which was the altitude to fly after the go-around and climb, and the PM confirmed the setting.
17:43:26	The PF returned the speed brakes that had been in use.
17:43:29	The PF ordered the PM to set FLAP to "2", and the PM confirmed the flight speed and adjusted the FLAP.
17:43:34	The PM called that the FLAP was "2".
17:43:35	The PF ordered the PM to the landing gear down, and the PM did so.
17:43:39	The PM called that gear down was complete.
17:43:40	PM turned off the anti-ice and called this.
17:43:41	The PF changed the flight speed mode to managed speed and called it.
17:43:43	The PM confirmed the PF's call.
17:43:48	The PM confirmed with the PF whether the ground wind direction reported from the east tower was 340°, and the PF replied that it was correct.
17:43:53	The PF called to begin slowing down the aircraft by using the speed brakes, and the PM acknowledged this.
17:44:00	There was an automatic callout of “Two thousand five hundred.”
17:44:02	The PF responded and said he could see the runway.
17:44:08	The PF informed the PM that the speed brakes had been armed, and the PM agreed.
17:44:17	The PF ordered the PM to set the FLAP to "3."

17:44:19	The PM confirmed the flight speed and applied FLAP.
17:44:22	The PM called that the FLAP was "3".
17:44:28	The PF ordered the PM to set the FLAP to "FULL".
17:44:31	The PM confirmed the flight speed and applied FLAP.
17:44:33	The PM called out that the FLAP had gone “FULL.”
17:44:38	The PF called out that the aircraft speed was 131 knots and that the speed brakes would be used, and the PM acknowledged this.
17:44:46	The PF called to end the use of the speed brakes by 1,300 ft, and the PM acknowledged this.
17:44:56	Aircraft B was cleared by the Tower East to land on runway 34R.
17:45:00	The PF called to say that landing clearance was granted.
17:45:01	The PM repeated to the Tower East that the aircraft was cleared to land on Runway 34R.
17:45:04	The PF read back the landing clearance and called out that the speed brakes had been armed, to which the PM acknowledged.
17:45:08	The PF ordered the PM to carry out the landing checklist.
17:45:10	The PM called to say that the landing checklist was complete, and the PF confirmed this.
17:45:29	The PM said, "If it becomes unstable, we'll go around."
17:45:32	The PF asked him to speak again.
17:45:33	The PM said, "If it becomes unstable, we will go around," and the PF understood.
17:45:38	The PF ordered the PM to monitor the flight speed, and the PM agreed.
17:45:41	The PF disengaged from the autopilot and switched to manual control.
17:45:47	The PF called "Approach 1" on the Flight Mode Announciators*[54] , which was confirmed by the PM.
17:45:52	There was an automatic callout of “One thousand.”
17:45:53	The PM confirmed that the plane was stable and called, which the PF confirmed.
17:46:01	The PF confirmed that the wind direction had changed and the PM responded.
17:46:22	Regarding the wind direction, the PF said, "It looks like we can continue with the head at this rate," to which the PM replied, "Yes, they said it was around 300 or 310, so that's about right."

*54 ‘Flight mode annunciators’ collectively display autopilot, flight guidance, landing capabilities and other information on the main flight instrument screen in the cockpit.

17:46:37	There was an automatic callout of “Five hundred”.
17:47:11	There was an automatic callout of “One hundred”.
17:47:15	There was an automatic callout of “Seventy”.
17:47:16	There was an automatic callout of “Sixty”.
17:47:17	There was an automatic callout of "Fifty".
17:47:18	There was an automatic callout of “Forty”.
17:47:19	There was an automatic callout of “Thirty”.
17:47:20	There was an automatic callout of “Twenty”.
17:47:21	There was an automatic callout of “Retarred”.
17:47:23	There was an automatic callout of “Retarred”.
17:47:27	At the same time as the sound of the impact, the PF cried out.
17:47:33	The PM said, "I have control," and the PF responded, "You have control."
17:47:44	The Training Crew said, "Left, left."
17:47:51	The Training Crew said, "Are you going left? Tiller, left."
17:47:59	The Training Crew asked, "Can you stop?"
17:48:04	The Training Crew said, "Stop (unintelligible)."
17:48:12	Impact sound
17:48:15	PIC B said, "We stopped, right?"
17:48:16	The Training Crew said, "There was a small plane."
17:48:17	PIC B said, "We stopped, right?"
17:48:17	"Yes, we've stopped," Training Crew said.
17:48:18	CVR recording stopped.

Attachment 2 Distribution of Wreckage