

AI2016-4

**AIRCRAFT SERIOUS INCIDENT
INVESTIGATION REPORT**

**JAPAN AIRLINES CO., LTD.
J A 8 2 9 9**

August 25, 2016

The objective of the investigation conducted by the Japan Transport Safety Board in accordance with the Act for Establishment of the Japan Transport Safety Board (and with Annex 13 to the Convention on International Civil Aviation) is to prevent future accidents and incidents. It is not the purpose of the investigation to apportion blame or liability.

Kazuhiro Nakahashi
Chairman,
Japan Transport Safety Board

Note:

This report is a translation of the Japanese original investigation report. The text in Japanese shall prevail in the interpretation of the report.

AIRCRAFT SERIOUS INCIDENT INVESTIGATION REPORT

JAPAN AIRLINES CO., LTD.

BOEING 767-300, JA8299

ATTEMPTED LANDING ON RUNWAY

OCCUPIED BY VEHICLE

TOKUSHIMA AERODROME

AT ABOUT 10:58 JST, APRIL 5, 2015

July 22, 2016

Adopted by the Japan Transport Safety Board

Chairman	Kazuhiro Nakahashi
Member	Toru Miyashita
Member	Toshiyuki Ishikawa
Member	Sadao Tamura
Member	Keiji Tanaka
Member	Miwa Nakanishi

SYNOPSIS

< Summary of the Serious Incident >

On Sunday, April 5, 2015, a Boeing 767-300; registered JA8299 and operated by Japan Airlines Co., Ltd. took off from Tokyo International Airport as scheduled flight 455 of the company, continued its approach to Runway 29 at Tokushima Aerodrome after receiving a landing clearance at 10:53, found a vehicle on the runway at about 10:58 after passing the runway threshold, and executed a go-around.

There were 67 people on board the aircraft, consisting of a Pilot in command, seven other crewmembers and 59 passengers. No one was injured.

< Probable Causes >

It is highly probable that the serious incident occurred as JA8299 attempted to land because local control at Tokushima Aerodrome control tower had issued a landing clearance to JA8299 on the runway occupied by the Work Vehicle.

It is probable that the Tower had issued a landing clearance to JA8299 to land because the Supervisor, who had the combined duties of the Tower and the Ground, had forgotten about the presence of the Work Vehicle. It is probable that contributing factors were that, in a situation in which only one Air Traffic Controller was on duty in the aerodrome control tower and no support could be received from other controllers, he was preoccupied with selecting a runway for the Departure Aircraft, and that he did not use a reminder indicating that the runway was unusable for take-offs and landings.

Abbreviations and Acronyms used in this report include the following:

AGL:	Above Ground Level
CLSD:	Closed
CVR:	Cockpit Voice Recorder
FDR:	Flight Data Recorder
FL:	Flight Level
ICAO:	International Civil Aviation Organization
MAC:	Mean Aerodynamic Chord
PF:	Pilot Flying
PM:	Pilot Monitoring
QAR:	Quick Access Recorder
RWY:	Runway

Unit Conversion Table

1 ft	: 0.3048 m
1 kt	: 1.852 km/h
1 nm	: 1,852 m

1. PROCESS AND PROGRESS OF AIRCRAFT SERIOUS INCIDENT INVESTIGATION

1.1 Summary of the Serious Incident

On Sunday, April 5, 2015, a Boeing 767-300; registered JA8299 and operated by Japan Airlines Co., Ltd. took off from Tokyo International Airport as scheduled flight 455 of the company, continued its approach to Runway 29 at Tokushima Aerodrome after receiving a landing clearance at 10:53, found a vehicle on the runway at about 10:58 after passing the runway threshold, and executed a go-around.

There were 67 people on board the aircraft, consisting of a Pilot in command, seven other crewmembers and 59 passengers. No one was injured.

1.2 Outline of the Serious Incident Investigation

This case corresponds to a situation equivalent to a “Landing on a closed runway or a runway being used by other aircraft or attempt of landing” in clause 2, Article 166–4 of the Ordinance for Enforcement of the Civil Aeronautics Act of Japan, and then it is thus classified as an aircraft serious incident.

1.2.1 Investigation Organization

On April 5, 2015, the Japan Transport Safety Board designated an investigator-in-charge and two investigators to investigate this serious incident.

1.2.2 Representatives from Foreign Authorities

The Japan Transport Safety Board notified the occurrence of the serious incident to the United States of America (the US), as the State of Design and Manufacturer of the aircraft involved in this serious incident. The US did not designate any accredited representatives.

1.2.3 Implementation of the Investigation

April 6 and 7, 2015 On-site investigation and interviews

1.2.4 Comments from Parties Relevant to the Cause of the Serious Incident

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

1.2.5 Comments from the Relevant State

Comments on the draft report were invited from the relevant State.

2. FACTUAL INFORMATION

2.1 History of the Flight

On April 5, 2015, a Boeing 767-300 registered JA8299, operated by Japan Airlines Co., Ltd. (hereafter referred to as “Aircraft A”), took off from Tokyo International Airport at 10:05 Japan Standard Time(JST:UTC+9hours, all times are indicated in JST on a 24 hour clock) as scheduled flight 455 of the company, received landing clearance from local control at Tokushima Aerodrome control tower (hereafter referred to as “the Tower”) at 10:53, and was on the approach to Tokushima Aerodrome (hereafter referred to as “the Aerodrome”).

The flight plan for Aircraft A was outlined below:

Flight rules:	Instrument flight rules (IFR)
Departure aerodrome:	Tokyo International Airport
Estimated off-block time:	09:45
Cruising speed:	464kt
Cruising altitude:	Flight Level (FL) 280
Route:	JYOGA (waypoint) – (omitted) – DATIS (waypoint)
Destination aerodrome:	The Aerodrome
Total estimated elapsed time:	54 min
Fuel load expressed in endurance:	2 h 33 min
Persons on board:	67 persons

In the cockpit of Aircraft A, the Pilot in command (hereafter referred to as “the PIC”) sat in the left seat as the PF*1 and the First Officer (hereafter referred to as “the FO”) sat in the right seat as the PM*1.

In the meantime, an electric maintenance worker of the Aerodrome (hereafter referred to as “the Worker”) had, after receiving permission from the Tower at 10:40, entered the runway in an electric maintenance work vehicle (hereafter referred to as “the Work Vehicle”) at about 10:43 to carry out the work of replacing bulbs in the runway distance marker lights.

The history of the flight leading to this serious incident was summarized below, based on the Air Traffic Control (hereafter referred to as “ATC”) communication records, data from the flight data recorder (hereafter referred to as “FDR”) and a transceiver lending record, and statements of the PIC, the FO, the ATC Facility Supervisor*2 (hereafter referred to as “the Supervisor”) and the Worker.

2.1.1 History of the Flight Based on the ATC Communication Records and Others

About 10:37 The Operation Duty Officer*3 lent the Worker a transceiver for

*1 PF (Pilot Flying) and PM (Pilot Monitoring) are terms used to identify pilots by their different roles in aircraft operated by two persons. The PF is mainly responsible for controlling the aircraft. The PM mainly monitors the flight status of the aircraft, cross-checks about the PF operation, and undertakes other than flight controlling.

*2 The “ATC Facility Supervisor” is a person who oversees crews in charge of ATC in aerodrome and terminal control towers. In this report, it refers to the person who was overseeing ATC in the control tower at Tokushima Aerodrome when this serious incident occurred, and was engaged in work for both local control and ground control at the time.

*3 “The Operation Duty Officer” is a person who gives flight approvals, provides aviation information, operates facilities directly necessary for the operation of aircraft, undertakes work related to dealing with aircraft distress, emergency situations and others. The Operation Duty Officer at the Tokushima Air Base of the Japan Maritime Self-Defense Force, a joint-use airport, also liaises and coordinates with the Tokushima Airport Office of the Osaka Regional Civil Aviation Bureau, Ministry of Land, Infrastructure, Transport and Tourism (hereafter referred to as “MLIT”), on matters concerning the operation of civil aircraft.

communication with the Tower.

About 10:37-40 The Operations Office (the office of the Operation Duty Officer) contacted the Tower with notification of work requiring entry to the runway to replace bulbs in the runway distance marker lights.

About 10:40 The Worker requested the Tower for permission to enter the runway, which the Tower approved.

About 10:43 The Worker entered the runway with the Work Vehicle and started the work.

About 10:50 Aircraft A established contact with the approach control of the Tokushima terminal control facility (hereafter referred to as “the Approach”) and requested an ILS Z RWY29 approach, whereupon the Approach started for vector to the final approach course.

10:51:25 A departure aircraft that was parked in Spot 4 (hereafter referred to as “the Departure Aircraft”) asked ground control at Tokushima Aerodrome control tower (hereafter referred to as “the Ground”) for a clearance to depart from Runway 11. The Ground did not give the Departure Aircraft a clearance to depart from Runway 11, because Aircraft A was scheduled to land Runway 29.

10:53:00 The Approach instructed Aircraft A to contact with the Tower.

10:53:09 The Air Traffic Controller of the Approach suggested to the Supervisor with a control telephone that Runway 11 should be used for departure by the Departure Aircraft. The Supervisor answered “Yes”.

10:53:11 Aircraft A began a contact with the Tower.

10:53:17 The Tower issued a landing clearance for Runway 29 to Aircraft A.

10:53:28 The Air Traffic Controller of the Approach again suggested to the Supervisor that Runway 11 should be used for departure by the Departure Aircraft. The Supervisor answered “Understood”.

10:57:07 Autopilot of Aircraft A was disengaged. (900 ft AGL)

10:57:54 The Departure Aircraft requested pushback*⁴.

10:57:58 The Ground issued a clearance for a pushback and a departure from Runway 11.

10:58:05 Aircraft A passed over near the threshold of Runway 29.

10:58:17 PIC of Aircraft A executed the go-around, and the main landing gear of Aircraft A touched down.

10:58:19 Aircraft A lifted off again.

10:58:24 Aircraft A passed over the Work Vehicle.

*⁴ “Pushback” is a maneuver whereby a parked departure aircraft is pushed backwards by a towing car to a point where it can commence the taxi out independently.

2.1.2 Statements of Flight Crewmembers

(1) PIC

According to the meteorological information on the Aerodrome obtained by the PIC during flight, the wind direction was 180° and the wind velocity was 20 kt, there was a strong crosswind component from the left, and there was also a tailwind component. Therefore, the PIC and the FO agreed that it was important not to deviate from the runway centerline during the approach, and that caution would be required during the landing maneuver.

During the final approach, the PIC visually recognized the runway at the point when altitude was 1,000ft or lower, but visibility was slightly blurred due to a light rain shower. At this time, the heading was pointing significantly to the left due to drift angle correction by the autopilot. The PIC reminded himself of the need to pay all due attention to aligning with the runway centerline and others after the autopilot was disengaged. As he had already received a landing clearance from the Tower at this time, he was not expecting the presence of vehicles or other obstacles on the runway.

The PIC disengaged the autopilot and continued the approach, and then at about 10:58, Aircraft A passed over the threshold of Runway 29. After hearing the automatic voice of 30 ft AGL, there was “Go-around” call from the FO when he attempted to commence a flare. The PIC thought that, normally, a go-around was nearly always caused by weather factors, such as poor visibility of the runway. Although he had deviated slightly to the left from the runway centerline at that point, he could see the runway. Since he thought that there would be no problem with the landing, he wondered the FO’s call for a moment and looked at the FO. Then, because the FO was staring ahead, he also turned his line of vision to the front, whereupon he found a single orange light near taxiway N-4, and thus became aware of presence of a vehicle.

The PIC immediately pressed the go-around switch, then carried out pitch control^{*5} while taking care to avoid a tail strike^{*6}. The PIC thought there was no danger of contact with the vehicle, because the vehicle was moving far from the expected touchdown point even if the main landing gears were to touch down after obtaining a go-around thrust.

(2) FO

The FO was mainly scanning the instruments (i.e. continuously monitoring them in an orderly sequence), as he had been instructed to do so by the PIC in the before landing briefing.

At around the time of commencing level flight at an altitude of 2,000 ft, he established radio contact with the Tower and received landing clearance from it. During the final approach, he was looking at the runway in between the instruments scanning. After commencing flare, he looked ahead and noticed the light from a rotating lamp. The FO thought that there was something; accordingly, he immediately made a go-around call, but he was concerned that his voice might have been constricted; therefore, so he repeated its call. Because there was no response from the PIC, the FO was about to override power himself, but immediately after this the PIC pressed the go-around switch.

When he made the go-around call, a vehicle was moving near taxiway S-4, and the point at which the Aircraft A flew over the vehicle was not certain, but is thought to have

^{*5} “Pitch control” is control of the vertical attitude of an aircraft.

^{*6} A “tail strike” is a contact between the rear section of the airframe and the runway when taking off or landing.

been above the runway near taxiway S-3.

2.1.3 Statement of the Supervisor

When the serious incident occurred, the Supervisor was supervising for four crewmembers in charge of the Tower. The duty area of said crewmembers was in the control tower, in connection with the maintenance work in preparation for a simultaneous inspection of facilities to be carried out within the following few days (see 2.9.2). On days when the air traffic volume is heavy, this maintenance work is undertaken outside the service hours of the ATC. On the day; however, there were no training flights and thus there was a room for ATC workload; therefor; Supervisor had planned in advance to use it to carry out the work.

The number of personnel assignment of the aerodrome control tower could be reduced depending on the volume of work, and a maintenance work was normally done on weekends and other days when the air traffic volume was light. The Supervisor was aware that the minimum number of personnel assignment of the aerodrome control tower should basically be two persons, but even in the past, this had sometimes been reduced to only one person because of meals and other circumstances, when there were no take-offs, landings or others air traffic.

On the day, the Supervisor took over from the previous crew at 07:30, then assigned two persons to carry out a maintenance work of a separate room, while another two persons including himself undertook aerodrome ATC and a maintenance work of the aerodrome control tower. As the maintenance work of the separate room was had not been finished by the time the maintenance work in the aerodrome control tower was complete, the Supervisor thought he could carry out the aerodrome ATC by himself, consequently, he sent the other Air Traffic Controller from the aerodrome control tower to carry out the work in there. Thus, the Supervisor was alone in the aerodrome control tower and carrying out aerodrome ATC, acting as both the Tower and the Ground combined, from about 10:10 of about 40 minutes before the incident occurred.

At about 10:40, there was contact from the Operations Office to the effect that the Work Vehicle would enter the runway in order to replace lightbulbs. Immediately after this, the Worker requested permission to enter the runway for the work of replacing bulbs in the runway distance marker lights with the transceiver. Although aircraft take-offs and landings were scheduled, the Supervisor, on checking the Tower bright display^{*7} (see Photo 2), found that the arrival aircraft was still far away. Therefore, he decided to have the Work Vehicle evacuate from the runway when the time for a take-off or landing was approaching, and thus gave permission to the Work Vehicle.

When giving permission for the Work Vehicle to enter the runway, a sign marked "RWY CLSD" (meaning that the runway was closed) masking part of the wind indicator would normally be used as a reminder (see 2.10.2). However, when the serious incident occurred, the Supervisor thought he could handle the situation by memory alone, because few take-offs and landings were scheduled. In addition, this reminder also had the significance of showing others that the runway was closed, and since there was no one else there at the time, he did not use it.

After this, the Supervisor placed a chair near the middle with the local console and the coordination console, and sat facing toward the runway at the front. (See Figure 1)

When the Departure Aircraft asked the Ground for ATC approval, the Supervisor replied that he could not give a clearance as, although there had been a request to depart from Runway 11, there was an approaching aircraft that was scheduled to land on Runway 29. After that,

^{*7} The "Tower bright display" is equipment used when confirming the positions of aircraft flying over the control zone and its vicinity, and providing information to aircraft. The positions of aircraft are displayed on a screen.

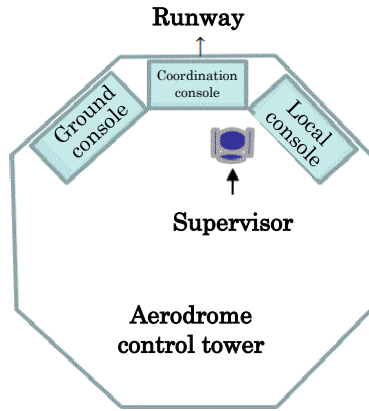


Figure 1 Seated position (image)

the Air Traffic Controller of the Approach, who was monitoring this communication, suggested that “the Departure Aircraft could use Runway 11.” In response to this, the Supervisor decided to have the Departure Aircraft hold on the taxiway until Aircraft A had entered the spot, then to have it depart from Runway 11 in the opposite direction. There was nothing unusual about this choice of runway, and the Supervisor had also adopted this method in the past. However, he had not thought of it this time until receiving the suggestion from the Air Traffic Controller of the Approach.

After this, when Aircraft A established radio contact with the Tower, the Supervisor looked at the runway and confirmed that there was no obstacle, then issued a clearance for landing.

Visibility was poor to the east, the direction of approach of Aircraft A, and the Supervisor first saw Aircraft A when it was around 3 nm from the runway. From this point on, the Supervisor focused attention on the two aircraft while imagining a sequence whereby the Arrival Aircraft would enter Spot No.3 while the Departure Aircraft was pushed back and holding on the taxiway, after which the Departure Aircraft would taxi and take off. (See Figure 2)

The Supervisor noticed the Work Vehicle just before Aircraft A touched down. He then remembered that he had given permission for the Work Vehicle to enter the runway, but because Aircraft A had already lifted off again, the Supervisor could no longer issue any instructions to neither Aircraft A nor the Work Vehicle.

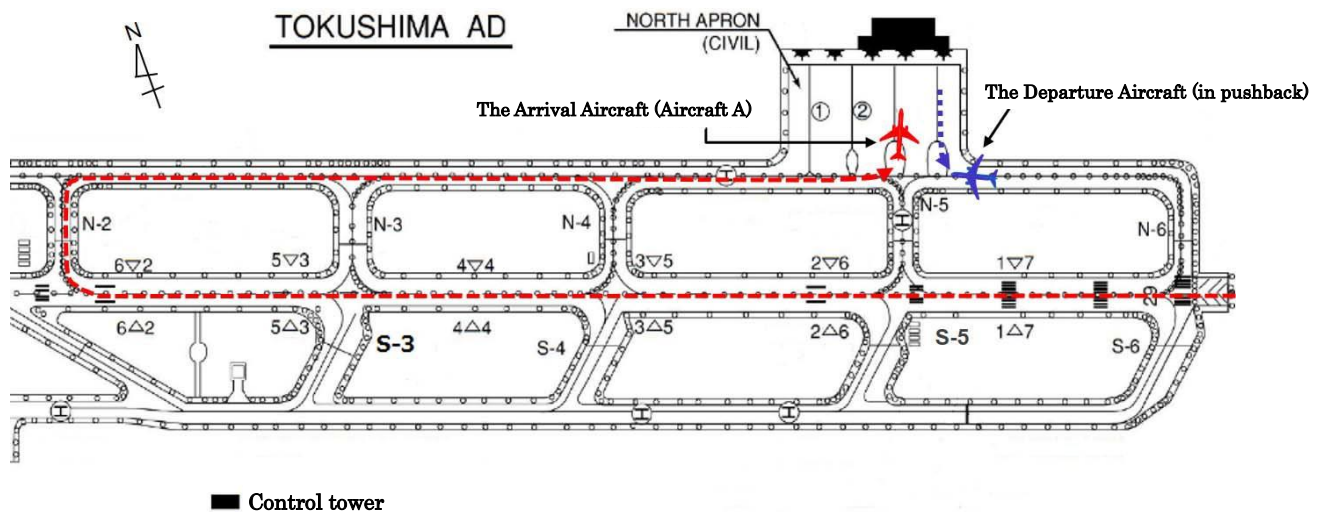


Figure 2 Image of positional relationship between the Departure Aircraft from Runway 11 and the Arrival Aircraft to Runway 29

2.1.4 Statement of the Worker

Three electrical maintenance workers are on duty in Tokushima air base during the daytime on weekdays, but as the serious incident occurred on Sunday; accordingly, there was only one worker on duty from 08:30 in the morning.

The work to replace bulbs in the distance marker lights had been postponed due to rain on the previous night, but because it was now possible, the Worker contacted the Operation Duty Officer to that effect and received permission for said work. The Worker went to the Operations office, where he borrowed a transceiver, then rode the Work Vehicle, received permission to enter the runway from the Tower with a transceiver, and entered the runway from taxiway S-1.

The Worker performed a repeated process whereby he stopped the Work Vehicle at the edge of the runway near a runway distance marker light and carried out the work, then moved to the next runway distance marker light. During this work, he found two unscheduled locations where runway distance marker lights were not lit (see ⑤ and ⑧ in Figure 3), and then added these to his work. Although he had checked the timetable in advance and was aware that the estimated time of arrival of a scheduled flight was approaching, he continued the work on the assumption that there would be an instruction from the Tower to evacuate from the runway before the landing. When he had finished changing all the lightbulbs, the vehicle was facing east (the direction toward the arrival aircraft), but the Worker could not see any aircraft.

After this, he turned around in order to leave the runway, but was startled to see the approaching Aircraft A in the rear view mirror of the Work Vehicle while he was driving along the runway toward taxiway S-3, and accelerated so as to get as far away from it as possible. When the Worker first noticed Aircraft A, it looked as if it had touched down on the runway, but it lifted off again immediately afterwards. The Work Vehicle was too fast the speed to enter the nearest taxiway S-3.

Although his memory was uncertain, he thought that Aircraft A passed over the Work Vehicle in the vicinity of taxiway S-3, at an altitude that was high enough to avoid a collision.

There was no particular reason why he did not leave from the nearest taxiway (S-5 or S-6) after finishing the work, other than that he usually left from the taxiway S-3 after entering the runway for work at night.

The serious incident occurred at the Aerodrome at 10:58 on April 5 (Sunday), 2015.

(See Appendix Figure 1, Appendix Figure 2)

2.2 Injuries to Persons

No one was injured.

2.3 Damage to the Aircraft

No damage was sustained to the aircraft.

2.4 Personnel Information

(1) PIC Male, Age 57

Airline Transport Pilot Certificate (Airplane)

May 16, 1994

Type rating for Boeing 767

June 28, 1991

Class 1 Aviation Medical Certificate

Validity

July 31, 2015

Total flight time	14,696 h 31 min
Flight time in the last 30 days	46 h 37 min
Total flight time on the type of aircraft	10,571 h 14 min
Flight time in the last 30 days on the type of aircraft	46 h 37 min
(2) FO Male, Age 33	
Commercial pilot certificate (Airplane)	November 6, 2009
Type rating for Boeing 767	May 22, 2014
Instrument flight certificate	May 27, 2010
Class 1 Aviation Medical Certificate	
Validity	October 9, 2015
Total flight time	628 h 39 min
Flight time in the last 30 days	52 h 38 min
Total flight time on the type of aircraft	362 h 58 min
Flight time in the last 30 days on the type of aircraft	52 h 38 min
(3) Supervisor Male, Age 30	
Air Traffic Controller Qualification Certificate	
Aerodrome control services	July 24, 2006
Medical certificate	
Validity	August 5, 2015

The Supervisor in charge of the Tower when the serious incident occurred had been engaged in operations other than ATC for about five and a half months from October 17, 2014 to March 31, 2015, after which he returned to ATC at the Aerodrome on April 1, 2015. On the day of this serious incident, he was performing aerodrome ATC for the second time since returning to ATC. In the Air Traffic Control Officer Examination Rules of the Civil Aviation Bureau, MLIT as applied to the Japan Maritime Self-Defense Force (hereafter referred to as “JMSDF”) Tokushima Air Training Group (hereafter referred to as “the ATG”), it is stipulated that personnel who have not performed ATC continuously for at least six months in a given ATC must not be appointed to that ATC unless they have been recognized by the head of that ATC to have the knowledge and skills necessary for implementing that work. Because the Supervisor did not fall under such a provision, he was immediately appointed to ATC after his return.

2.5 Aircraft Information

2.5.1 Aircraft

Type	Boeing 767-300
Serial number	24498
Date of manufacture	August 4, 1989
Certificate of airworthiness	Dai-2009-107
Validity	The period during which the Maintenance Management Manual (JAL Engineering Co., Ltd.) applies from October 1, 2009.
Category of airworthiness	Aircraft Transport T
Total flight time	58,143 h 06 min

2.5.2 Weight and Balance

At the time of the serious incident, the weight of the Aircraft is estimated to have been 221,000 lb and the position of the center of gravity 20.2% mean aerodynamic chord (MAC), both of which are estimated to have been within the allowable range (maximum landing weight of 295,000 lb, range of position of center of gravity corresponding to the weight at the time of the serious incident, 7.0-37.0% MAC).

2.6 Meteorological Information

Aviation weather observations at the Aerodrome were as follows.

10:00 Wind direction: 190°, Wind velocity: 20 kt, Prevailing visibility: 10 km or more

Cloud: Amount 3/8, Type Stratus, Cloud base 1,000 ft

Amount 6/8, Type Cumulus, Cloud base 2,000 ft

Amount 7/8, Type Stratocumulus, Cloud base 8,000 ft

Temperature: 17°C, Dew point: 16°C

Altimeter setting (QNH): 29.89 inHg

11:00 Wind direction: 180°, Wind velocity: 20 kt, Visibility: 10 km or more

Cloud: Amount 4/8, Type Stratus, Cloud base 1,000 ft

Amount 6/8, Type Cumulus, Cloud base 2,000 ft

Amount 7/8, Type Stratocumulus, Cloud base 8,000 ft

Temperature: 17° C, Dew point: 16° C

Altimeter setting (QNH): 29.88 inHg

2.7 Information on Communications

At the time of the serious incident, the communication equipment installed in the Aerodrome and the transceiver used for communication between the Worker and the Tower were operating normally, and communications between the Tower and Aircraft A and between the Tower and the Work Vehicle were in good condition.

2.8 Information on the Flight Recorder

Aircraft A was equipped with an FDR capable of recording for at least 25 hours and a cockpit voice recorder capable of recording for two hours (hereafter referred to as "CVR"), both manufactured by Honeywell of the United States of America. After the serious incident, Japan Airlines Co., Ltd. made an inquiry to the Civil Aviation Bureau, MLIT as to whether the Aircraft could operate its next flight, and a reply was received from the Bureau, based on information received at the time, to the effect that the Aircraft could operate. As a result, the Aircraft continued to operate from the next flight onwards with the FDR and CVR still equipped. Subsequently, this case was judged to correspond to a serious incident, whereupon preservation measures were taken and the FDR was retrieved, and the records from the time of the incident retained. However, since it was obvious that the records from the time of the incident on the CVR had been overwritten and erased, it was not retrieved.

The time calibration for the FDR was conducted by comparing the time signals recorded in the ATC communication records with the VHF keying signals recorded in the FDR.

2.9 Aerodrome Information

2.9.1 Outline of the Aerodrome

The Aerodrome is the only joint-use airport of the JMSDF used jointly by civilian aircraft and Self-Defense Force (hereafter referred to as “SDF”) aircraft. The ATG operates the Aerodrome, including the ATC. As of April 2015, the Aerodrome served 28 civilian scheduled flights per day. The JMSDF carries out pilot training in the Aerodrome, and the number of take-offs and landings varies greatly from day to day, depending on the implementation status of training. According to actual figures for April 2015, the maximum number of take-offs, landings and others in one day was 208 times, but on weekends, public holidays and other days when there is no training, this number was around 30 times per day.

ATC provided at the Aerodrome and other joint-use airports constructed and managed by the Ministry of Defense are implemented in accordance with regulations compliant with the Air Traffic Services Procedure prescribed by the Civil Aviation Bureau, MLIT. Qualifying examinations for the Air Traffic Controllers who implement ATC are held by the Civil Aviation Bureau based on its own Air Traffic Control Officer Examination Rules. In addition, the Civil Aviation Bureau systematically confirms the implementation status of ATC.

2.9.2 Maintenance Work

The ATG carries out inspections on the maintenance status of facilities, equipment and others inside the base two or three times a year, overseen by a commanding officer or similar. In parallel to its normal operations, each unit carries out a maintenance work in preparation for inspections. The personnel to be engaged in this work are appointed separately and they implement the work. A pre-inspection of the work status was scheduled to take place three days after the serious incident. The crew to which the Supervisor belongs was planning to complete said maintenance work during the day of the serious incident, taking account of working days on either side, among other factors.

2.9.3 Runways and Runway Distance Marker Lights

The Aerodrome has one runway with a length of 2,500 m, a width of 45 m, and an orientation of 11 / 29, with a total of 14 runway distance marker lights located on both sides of the runway at equal intervals of about 1,000ft (about 305m) inside the landing area*⁸ (outside the runway) parallel to the runway centerline and about 50m away from said centerline. The lights are configured to display distances in units of 1,000 ft using about 10-20 light bulbs for each numeral. Runway distance marker lights are useful equipment for pilots when ascertaining the remaining length of the runway, but a malfunction of these fixtures will not compromise the operation of aircraft.



Photo 1 Runway Distance Marker Lights

*⁸ “Landing area” refers to a rectangular area including the runway and surrounding area which is established and extended to the specific direction to serve for take-off or landing of aircraft.

2.10 Operation of Air Traffic Control

2.10.1 Numbers of Personnel to be Assigned for the Aerodrome Control Tower

According to ATG internal regulation (Chief of Base Operation Division Instruction No.10, dated November 15, 2011), before the serious incident occurred, it was stipulated that the standard personnel composition in the aerodrome control tower should consist of four persons, but that this could be reduced within a range that would not obstruct the ATC, taking account of weather conditions, traffic conditions and the proficiency of the Air Traffic Controllers. However, no specific minimum number of personnel was stipulated, and the only guidance was a verbal instruction that the minimum should be two persons. On weekends, public holidays and other days, two persons were often assigned to the aerodrome control tower in line with this regulation, but on the day four persons were assigned in view of the personnel requirements for maintenance work.

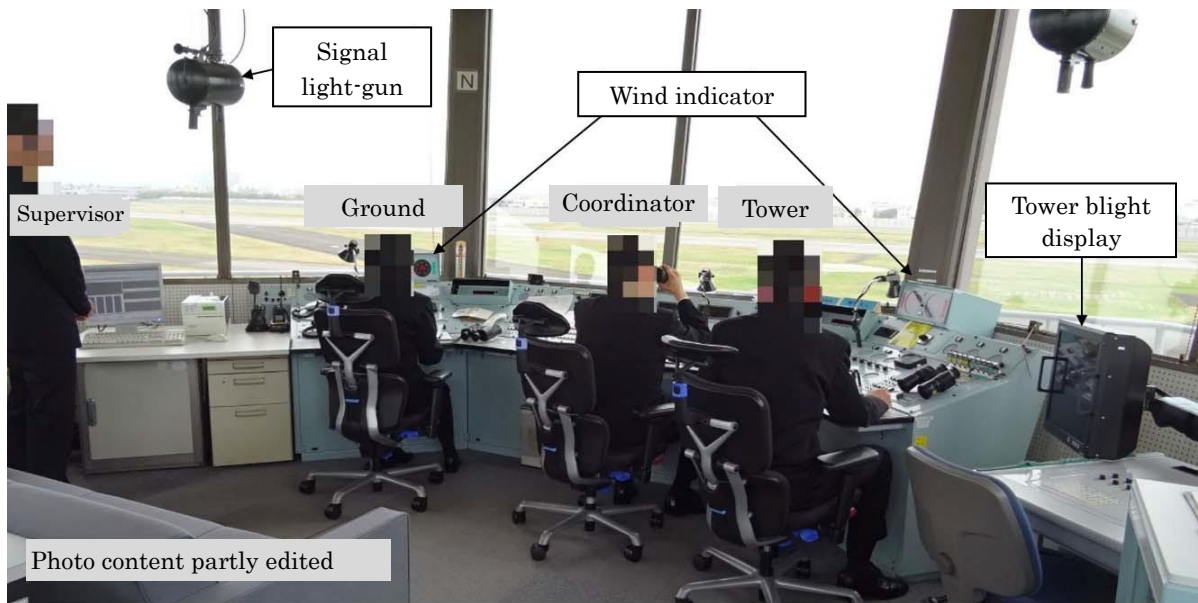


Photo 2 Standard layout of the Aerodrome control tower

2.10.2 Use of the Reminder

In the control tower of Aerodrome, the method of hanging a sign marked “RWY CLSD” (meaning that the runway was closed) over part of the display on the wind indicator installed on the Tower and the Ground control consoles was adopted, as a reminder to raise attention in situations when the runway could not be cleared for take-offs and landings due to runway closed or other reasons. If the reminder is used, the sign can be expected to be noticed when checking the wind direction and velocity, which are provided at the same time, thereby preventing the issuance of the clearance of take-offs and landings on the runway when it closed or otherwise cannot be used, even if the Tower mistakenly intends to issue the clearance for take-offs and landings. Although the use of this reminder has not been stipulated, it had been practiced routinely since around 2007.



Photo 3 Situation of the reminder in use

2.11 Work in Restricted Areas

2.11.1 Training of Vehicle Drivers and Persons Engage in the Work

After providing the necessary training in knowledge such as vehicle speed limitations in restricted areas to SDF personnel who drive vehicles in such areas, the ATG imposed written and practical tests and qualified. Meanwhile, for employees of contractors entrusted with services of electric maintenance for the aviation lights and others in the Aerodrome, the ATG provided the requisite training using pre-educational materials, and engaged them in this work after confirming their understanding in practical examinations only.

2.11.2 Work Requiring Access to the Landing Area and Taxiways

All work undertaken inside aerodromes required permission from the Operation Duty Officer based on the Tokushima Airfield Regulations (hereafter referred to as “the Airfield Regulations”) set forth by the ATG. For work that restricted the use of runway and other facilities, the restrictions on flight operation were announced via aeronautical information after coordinating the scope and duration of the work, the work vehicles approach routes and other details in writing in advance, and an inspector or other personnel was allocated to supervise the work. The work of replacing bulbs in the runway distance marker lights was undertaken without restricting the use of runways or other facilities, since the work could be interrupted immediately and the vehicle could be evacuated outside the runway following an instruction from the Air Traffic Controller.

In the case of a minor work such as the one done during the serious incident, the prior written coordination was omitted, and the procedure followed was that the Operation Duty Officer, when lending a transceiver used for communication with the Tower, gave permission for the work after confirming the work location and advising on precautions, then contacted the control tower of Aerodrome or terminal control facility by telephone with an outline of the work.

2.11.3 Communication Guidelines

According to the Airfield Regulations, personnel or vehicles entering the landing area or taxiways were to carry transceivers capable of communicating with the Tower, and to make contact with the Tower and get permission as well as complying with instructions. However, there was no regulation on communication guidelines, such as contact regarding the start or end of work. According to the Worker, one or more of his colleagues would make contact at regular points during the work, such as when moving to a different work location, but he only contacted the Tower when requesting permission to enter the runway before starting the work and on completing the work. When working on weekdays at times when air traffic volume was heavy, detailed instructions would be issued; on the contrary when working during times on weekends, public holidays and other days when air traffic volume was light, they were not always issued. On the day of this serious incident, the Worker did not make contact to indicate when he was moving among the work locations, he had added the two locations for bulb replacement works shown as ⑤ and ⑧ in Figure 3, which were not originally scheduled, nor that he had completed the work. Moreover, he was not requested by the Tower to make contact on completing the work, either.

When workers had entered the runway and the need arose to have them evacuate in an emergency, and also when the transceiver could not be used due to trouble and others, the method of using the signal light-gun (see Photo 2) to emit a red flashing light, or blinking the runway lights, was adopted as a method of transmitting instructions from the Tower.

2.11.4 Electric Maintenance



Photo 4 The Work Vehicle

Vehicles used for electric maintenance work were owned by a contractor entrusted with this work and permanently stationed in the Aerodrome. These had been cleared for use inside the Aerodrome.

Of the electric maintenance work, the work of replacing bulbs in the runway distance marker lights could be performed without vehicle entering the runway,

but it was normally driven onto the runway and the work carried out while moving to each work location in turn, in order to reduce the working hour.

In principle, the ATG had the work of replacing bulbs in the runway distance marker lights carried out at night or in the early morning when no aircraft were scheduled to take-off or landing, but also the work was sometimes carried out during the day.

Meanwhile, based on a system of work attendance by three persons during the day on weekdays, work requiring access to the landing area and taxiways was undertaken by two to three persons. On the other hand, at night-times on weekdays and at day-time and night-time weekends and public holidays, one person was on duty, and at these times communication with the Tower, monitoring of the vicinity and the work itself would inevitably be carried out by one person.

When the serious incident occurred, the Work Vehicle had its yellow rotating light on.

2.11.5 Bulb Replacement Work on the Day of the Incident

Of the 14 runway distance marker lights located along the side of the Aerodrome runway, the locations of bulb replacement work by the Worker when the serious incident occurred were positions of ⑩, ⑨, ⑧, ⑥, ⑤ and ④, shown in red in Figure 3. The time needed to change the bulbs was about one to two minutes in each location, and during the work, the Worker stopped the

vehicle at the edge of the runway near the runway distance marker lights. Also, after finishing the work at ④, he moved the vehicle to a point between ① and ② to confirm that their lights were working, inspected them by sight from inside with the vehicle running, and then he turned in order to leave the runway and drove along the runway. Until he noticed Aircraft A, he was moving at a speed of 40-50 km/h, including when moving between work locations. (According to the Airfield Regulations, the speed limit for vehicles on the runway was 60 km/h, except in emergencies and other similar cases.)

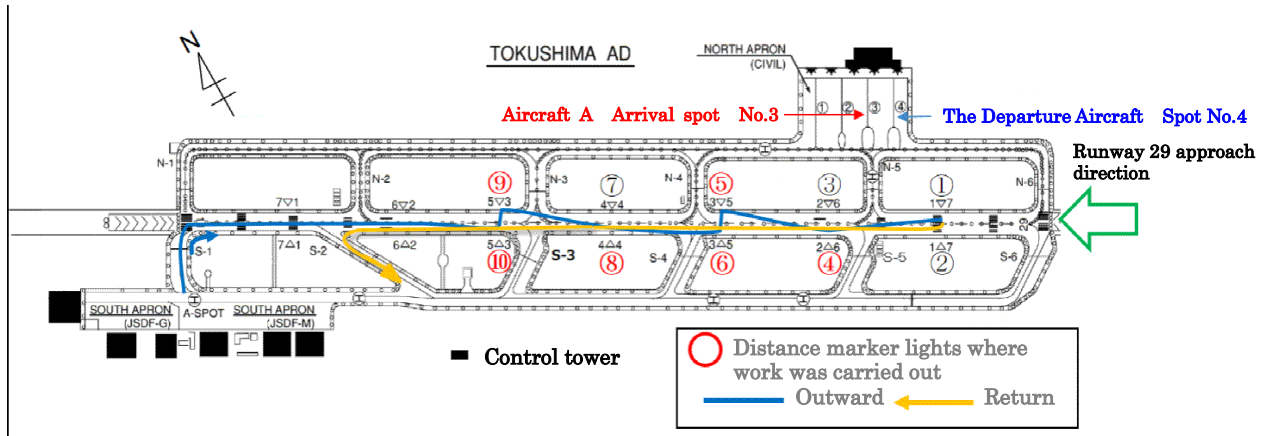


Figure 3 Work locations and route travelled by the Work Vehicle

3. ANALYSIS

3.1 Qualifications of Personnel

The PIC and the FO had valid airman competence certificates and valid aviation medical certificates.

3.2 Aircraft Airworthiness Certificate

The Aircraft had a valid airworthiness certificate, and had been maintained and inspected as prescribed.

3.3 Air Traffic Controller's Qualifications

The Supervisor held the necessary air traffic controller qualification certificate and medical certificate.

3.4 Effects of Meteorological Conditions

As described in 2.6, when the serious incident occurred, a prevailing visibility was 10 km or more, but according to the statement in 2.1.3, it is probable that visibility in the direction of the final approach course of Aircraft A was rather poor, and that the cloud base was about 1,000 ft.

Moreover, as described in 2.1.2, the PIC and FO of Aircraft A stated that, as they were landing under a strong crosswind, they had to be careful not to deviate from the runway centerline. Furthermore, there was a light rain shower in the sky. It is somewhat likely that these contributed to the fact that neither the PIC nor the FO noticed the vehicle until they had passed the runway threshold.

3.5 Situation of the Flight and ATC

3.5.1 Situation Until Immediately Before Landing Clearance was Issued

As described in 2.1.3, it is highly probable that, the Supervisor took over from the previous crew at 07:30, then assigned two persons to carry out the maintenance work described in 2.9.2 in a separate room as planned in advance, while other two persons including himself undertook aerodrome ATC and maintenance work in the aerodrome control tower. It is highly probable that, at about 10:10, the Supervisor sent the other Air Traffic Controller from the aerodrome control tower to carry out the work in the separate room, after which only the Supervisor remained in the aerodrome control tower, where he carried out aerodrome ATC.

It is probable that, at about 10:40, on receiving a permission request from the Worker to enter the runway, the Supervisor judged that there was enough time until Aircraft A landed, and thus gave permission. Although it should not have been possible to issue clearance for take-offs or landings at this time, it is highly probable that the Supervisor did not use the reminder that was normally used, as described in 2.10.2, at this time.

As described in 2.11.3, it is highly probable that, the Worker undertook the work of replacing bulbs in the runway distance marker lights without reporting to the Tower that he was moving among the work locations and that he had added the two bulb replacement work locations ⑤ and ⑧, which were not originally scheduled.

3.5.2 Situation from Immediately Before the Issuance of Landing Clearance Until the Go-around

(1) Situation of the Tower

As described in 2.1.1 and 2.1.3, it is probable that, when responding to the departure request from Runway 11 by the Departure Aircraft that was parked in Spot No.4, the Supervisor did not give the Departure Aircraft clearance to depart from Runway 11 because Aircraft A was going to land on Runway 29.

Moreover, as described in 2.1.1, the Supervisor received suggestions from the Air Traffic Controller of the Approach, just before and just after he issued the landing clearance of Aircraft A on Runway 29, that the Departure Aircraft should be allowed to use Runway 11. It is probable that the Supervisor judged this suggestion reasonable and gave a clearance for departure from Runway 11, which he had initially not given, due to the positional relationship between the parking areas of the two aircraft.

It is somewhat likely that the Supervisor was preoccupied with selecting the departure runway for the Departure Aircraft, causing him to forget about the presence of the Work Vehicle and to give landing clearance to Aircraft A.

Furthermore, as described in 2.1.1, because the communication records included no instruction to cancel the clearance after landing clearance had been issued for Aircraft A, it is probable that, after the Supervisor had mistakenly given its landing clearance, he focused his attention on the relationship between Aircraft A and the Departure Aircraft, did not remember the presence of the Work Vehicle; accordingly, he did not correct the clearance. Because Aircraft A had already started to climb during going around when the Supervisor noticed the presence of the Work Vehicle, it is probable that he had no time to issue instructions either to both.

(2) Situation of Aircraft A

As described in 2.1.2, it is highly probable that, the PIC and the FO of Aircraft A, having received landing clearance, caught sight of the runway when the altitude was below 1,000 ft at a point about 3 nm from the runway. It is probable that after the PIC commenced the flare when the altitude was below 30 ft AGL, but before touchdown, the FO first found the Work Vehicle and called "Go-around", whereupon the PIC heard the call; consequently, he aware of the Work Vehicle and executed the go-around.

3.6 Air Traffic Control

3.6.1 Characteristics of Air Traffic at the Aerodrome

As described in 2.9.1, the number of aircraft handled by ATC at the Aerodrome differed greatly depending on the day of the week. The Air Traffic Controllers has a relatively great volume of ATC during the day on weekdays, but it is probable that, because the serious incident occurred on a Sunday, the air traffic volume only consisted of about two civil scheduled flights every hour; therefore, the work volume was small. It is probable that this lay behind the Supervisor's decision to reduce the number of personnel in the aerodrome control tower to just one.

3.6.2 Visibility from the Aerodrome Control Tower When Landing Clearance was Issued

As described in 2.6 and 2.11.4, since a prevailing visibility was 10 km or more when the serious incident occurred, and the Work Vehicle had its rotating light on, it is probable that the Supervisor was in a situation which he could see the Work Vehicle. Besides, as described in 2.1.3, the Supervisor stated that he confirmed visually that there were no obstacles on the runway before

issuing landing clearance to Aircraft A. However, it is somewhat likely that the Supervisor did not notice the Work Vehicle because he had forgotten its presence, and had convinced himself that there were no obstacles on the runway.

3.6.3 Change to the Take-off Runway of the Departure Aircraft

As described in 3.5.2, before and after Aircraft A communicated with the Tower, the Air Traffic Controller of the Approach suggested to the Supervisor that the Departure Aircraft should be allowed to use Runway 11. It is probable that this was one reasonable option, in view of the request from the Departure Aircraft as well as the positional relationship between the two aircraft and the spots used respectively for parking.

3.6.4 Experience of the Supervisor

As described in 2.4 (3), the Supervisor had been engaged in operations other than ATC for about five and a half months, after which he returned to this operation and served in aerodrome ATC for a second time at the time the serious incident occurred. It is somewhat likely that this contributed to the Supervisor being preoccupied with selecting a runway for the Departure Aircraft, which he would previously have been able to implement smoothly, and forgetting about the presence of the Work Vehicle.

3.6.5 Using the Reminder to Prevent Lapses of Memory

As described in 2.10.2, the method of hanging a sign over part of the display on the wind indicator in the control tower of Aerodrome had been adopted prior to the occurrence of the serious incident, as a reminder that the runway could not be cleared for take-offs and landings due to the presence of work vehicles on the runway and others. However, it was not used when the serious incident occurred. It is probable that the Supervisor's memory of allowing the Work Vehicle to enter the runway would have been reinforced by the action of hanging the reminder sign. It is also probable that he would have noticed the reminder when checking the wind direction and velocity, which are provided at the same time as giving landing clearance, and he could have realized that the runway was not usable.

It is somewhat likely that the fact that the Supervisor did not to use the reminder contributed to his failure to notice the presence of the Work Vehicle, either before or after giving landing clearance to Aircraft A. It is probable that he did not use the reminder because, as described in 2.1.3, he judged that he could cope with the situation by memory alone since it was a day when the air traffic volume was light, but it is probable that the reminder would have been effective precisely in this kind of occurrence when there was only one person in the control tower.

3.6.6 Regulation on Number of Personnel to be Assigned for the Aerodrome Control Tower, and the Application Thereof

- (1) As described in 2.10.1, the regulation in the ATG was that the standard personnel composition was four persons, but that this number could be reduced in accordance with the traffic conditions and others. However, no minimum requirement was stipulated when reducing personnel, the only guidance being a verbal instruction that the minimum should be two persons.

As described in 2.1.3, it is probable that, the Supervisor was aware that the minimum requirement was two persons when reducing personnel, but that, as described in 2.9.2, he

made the judgment to take care of aerodrome ATC on his own because he was planning to have the maintenance work completed in the course of that day. It is somewhat likely that this was due to the fact that no minimum requirement was stipulated when reducing personnel and the only guidance was a verbal instruction that the minimum should be two persons, that the Supervisor thought he could with this situation by himself as there were only two scheduled take-offs and landings during the time when the serious incident occurred, that two persons had customarily been assigned on weekends, public holidays and other days, and that there had been occasions in the past when only one person was on duty during times when there were no take-offs or landings.

- (2) It is probable that the Supervisor, who was combining the duties of the Tower and the Ground as a result of reducing the personnel number to one, was preoccupied with selecting a runway for the Departure Aircraft, and thus forgot about the presence of the Work Vehicle on the runway. It is somewhat likely that, if more than one Air Traffic Controller had been on duty, support from another Air Traffic Controller, such as pointing out the mistaken landing clearance given to Aircraft A, could have been expected.

Even highly skilled operators can be prone to lapses of memory and other human error, and to deal appropriately with this, it is considered desirable that more than one Air Traffic Controller should be on duty in the control tower.

3.7 Work on Landing Area and Taxiway

3.7.1 Contact with the Tower

As described in 2.11.3, there were no communication guidelines on work requiring entry to the landing area and taxiway. On the day of the serious incident, the Worker neither had contacted the Tower, nor had been requested to contact the Tower, when moving among work locations on the runway, when adding work locations, or when completing the work. These contacts could have been expected to reinforce the Supervisor's awareness of the presence of the vehicle, and it is probable that the fact that none of these contacts was the contributing factor behind the Supervisor forgetting about the presence of the Work Vehicle.

3.7.2 System for Monitoring the Vicinity During the Work

As described in 2.11.4, more than one worker was on duty during the day on weekdays, but at night and on weekends, public holidays and other days, only one person was assigned. Because the serious incident occurred on a Sunday, a bulb replacement work, monitoring of the vicinity and handling of the transceiver were all carried out by the Worker alone. It is somewhat likely that this is why the Worker did not notice Aircraft A until the last moment, even though it was visible at about 3 nm from the runway threshold. Moreover, when working alone, it is somewhat likely that instructions from the Tower with flashing the signal light-gun or blinking the runway lights, as described in 2.11.3, would not be noticed.

From the above facts, it is desirable that the ATG should ensure that the work on landing area and taxiway is carried out at all times in the system that can respond to the neighboring monitoring and radio call.

3.7.3 Restrictions on Enter to the Runway by Vehicles and Others

- (1) Permission for work by the Operation Duty Officer

Because runways are facilities used for take-offs and landings by aircraft, work that

requires entry by vehicles and personnel during times when take-offs and landings are scheduled must be considered carefully at the stages of work planning and approvals.

Though permitting entry to the runway and allowing this work to be done, the ATG in principle only allowed it to be undertaken at night after flight operations had ended or early in the morning before the start of operations. On the day; however, permission for the work was given by the Operation Duty Officer. According to the description in 2.9.3, a bulb replacement work for a few burned-out bulbs that had occurred individually in the runway distance marker lights was a non-urgent work; however, it is probable that the fact that this work was undertaken during the time when take-offs and landings were scheduled, contrary to the basic principle, was the contributing factor of the occurrence of the serious incident.

(2) Awareness of the Worker

It is probable that the Worker did not contact the Tower to the effect that he intended to leave the runway using a forward taxiway instead of using the nearest one after finishing the work, and that additional work locations not originally scheduled had arisen, because he was not sufficiently aware that the time of occupation of the runway should be kept to the minimum. It is somewhat likely that the Worker was not sufficiently aware of this because the education given to the Worker by the ATG was inadequate.

3.8 Distance at Closest Proximity

It is probable that the point when Aircraft A came into closest proximity to the Work Vehicle was when it passed above the vehicle. Accordingly to the FDR records and others, the AGL (the height from the runway surface to the bottom of the main landing gear) at the time when Aircraft A passed over the Work Vehicle is estimated to have been about 40 ft (about 12 m).

(See Appendix Figure 1: Estimated Flight Path, Appendix Figure 2: FDR records)

3.9 Severity Classification

The classification of severity relevant to the serious incident according to ICAO Doc 9870 Manual on the Prevention of Runway Incursions, as a result of appraisal using a computer program provided by ICAO, corresponds to “Category A: *A serious incident in which a collision is narrowly avoided.*” (See Attachment)

4. CONCLUSIONS

4.1 Findings

(1) Effects of Meteorological Conditions

It is somewhat likely that strong crosswind and a light rain shower contributed to the fact that neither the PIC nor the FO noticed the vehicle until they had passed the runway threshold. (3.4)

(2) Situation until immediately before landing clearance was issued

It is probable that, on receiving a permission request from the Worker for to enter the runway at around 10:40 when the Supervisor was alone in the aerodrome control tower, he judged that there was enough time until Aircraft A landed, and thus gave a permission. At this time, it is highly probable that, the Supervisor did not use the reminder to prevent mistaken issuance of clearance for take-offs and landings.

It is highly probable that the Worker, after receiving permission to enter the runway, undertook the work of replacing bulbs in the runway distance marker lights without reporting to the Tower that he had added bulb replacement work in locations that were not originally scheduled. (3.5.1)

(3) Situation from immediately before the issuance of landing clearance until the go-around

It is probable that the Supervisor, on receiving the suggestion from the Air Traffic Controller of the Approach that the Departure Aircraft should use Runway 11 for departure, judged it reasonable and gave a clearance for a departure from Runway 11 due to the positional relationship between the parking areas of the two aircraft.

It is somewhat likely that the Supervisor was preoccupied with selecting the departure runway for the Departure Aircraft, causing him to forget about the presence of the Work Vehicle and issued a landing clearance to Aircraft A.

It is probable that after the PIC commenced the flare when the altitude was below 30 ft AGL, but before touchdown, the FO first found the Work Vehicle and called "Go-around", whereupon the PIC heard the call; consequently, he aware of the Work Vehicle and executed the go-around. (3.5.2)

(4) Air Traffic Control

1) It is probable that the fact that the volume of ATC work on the day of the serious incident was smaller lay behind the Supervisor reducing the number of personnel in the aerodrome control tower to just one. (3.6.1)

2) It is probable that the Supervisor was in a situation in which he could see the Work Vehicle. Besides, as described in 2.1.3, the Supervisor stated that he confirmed visually that there were no obstacles on the runway before issuing landing clearance. However, it is somewhat likely that the Supervisor did not notice the Work Vehicle because he had forgotten about its presence, and had convinced himself that there were no obstacles on the runway. (3.6.2)

3) It is probable that the suggestion by the Air Traffic Controller of the Approach concerning the runway to be used by the Departure Aircraft was one reasonable option. (3.6.3)

4) It is somewhat likely that the fact that the Supervisor had been engaged in operations other than aerodrome ATC for about five and a half months contributed to his forgetting

about the presence of the Work Vehicle. (3.6.4)

5) It is probable that the fact that the Supervisor did not use the reminder contributed to his failure to notice the presence of the Work Vehicle at the point of issuing landing clearance to Aircraft A. (3.6.5)

6) It is somewhat likely that the Supervisor's judgment that he would take care of aerodrome ATC on his own because there was no regulation stipulating a minimum requirement of personnel but only the verbal guidance that it should be two persons, that there were only two scheduled take-offs and landings, and that there had been times in the past when only one person was on duty. (3.6.6 (1))

7) It is probable that the Supervisor, who was combining the duties of the Tower and the Ground as a result of reducing personnel number to one, was preoccupied with selecting a runway for the Departure Aircraft, and thus forgot about the presence of the Work Vehicle on the runway. It is somewhat likely that, if more than one Air Traffic Controller had been on duty, support from another Air Traffic Controller could have been expected. (3.6.6 (2))

(5) Work on the runway

1) It is probable that the Worker did not contact the Tower either when moving among work locations on the runway, or when adding work locations, or when completing the work due to the fact that there were no communication guidelines on work requiring entry to the landing area between the Worker and the Tower was one of the contributing factor behind the Supervisor forgetting the presence of the Work Vehicle. (3.7.1)

2) It is somewhat likely that the Worker did not notice the presence of Aircraft A until just before it landed because a bulb replacement work, monitoring of the vicinity and handling the transceiver were all carried out by the Worker alone. It is desirable that the ATG should ensure that work on the landing area and taxiways is carried out at all times in the system that can respond to the neighboring monitoring and radio call. (3.7.2)

3) It is probable that the fact that the ATG undertook a non-urgent work during a time when aircraft take-offs and landings were scheduled was the contributing factor of the occurrence of this serious incident. It is also somewhat likely that the Worker did not make the necessary contact or leave the runway promptly after completing the work because the education given to the Worker by the ATG concerning work on runway and others was inadequate. (3.7.3)

(6) Distance at closest proximity

It is probable that the point when Aircraft A came into closest proximity to the Work Vehicle was when Aircraft A passed above the vehicle. Accordingly to FDR records and others, the AGL (the height from the runway surface to the bottom of the main landing gear) at the time when Aircraft A passed over the Work Vehicle is estimated to have been about 40 ft (about 12 m).

(See Appendix Figure 1: Estimated Flight Path, Appendix Figure 2: FDR Records) (3.8)

(7) Severity Classification

The classification of severity relevant to the serious incident, according to ICAO Doc 9870 Manual on the Prevention of Runway Incursions, corresponds to "Category A: *A serious incident in which a collision is narrowly avoided.*" (See Attachment) (3.9)

4.2 Probable Causes

It is highly probable that the serious incident occurred as Aircraft A attempted to land because the Tower had issued a landing clearance to Aircraft A on the runway occupied by the Work

Vehicle.

It is probable that the Tower had issued a landing clearance to Aircraft A to land because the Supervisor, who had the combined duties of the Tower and the Ground, had forgotten about the presence of the Work Vehicle. It is probable that contributing factors were that, in a situation in which only one Air Traffic Controller was on duty in the aerodrome control tower and no support could be received from other controllers, he was preoccupied with selecting a runway for the Departure Aircraft, and that he did not use a reminder indicating that the runway was unusable for take-offs and landings.

5. SAFETY ACTIONS

5.1 Safety Actions Taken After the Serious Incident

5.1.1 Main Safety Actions Taken by the ATG

- (1) Education and guidance on this incident
 - 1) After giving an outline explanation of the incident, the ATG gave guidance on precautions when entering the aerodrome to all enrolled air traffic controllers and workers. It also decided to give this guidance every year.
 - 2) Of past investigations conducted by the Japan Transport Safety Board and others, it introduced cases of aircraft accidents and serious incidents involving air traffic controllers and others, and gave training on errors (such as mistakes and lapses of memory) to which air traffic controllers might be prone.
 - 3) In unit of each crew, it did the case studies of aircraft accidents and serious incidents caused by air traffic control in Japan and abroad, and took steps to prevent erosion of the lessons learned by sharing the results with the whole base.
 - 4) It decided that the ATC audits periodically conducted by the ATG would confirm that air traffic controllers are confirming the situation on the runway both by sight and by “pointing and calling” (pointing with the index finger and calling the confirmation) when they give a clearance for take-off and landing.
- (2) Enforced indication of runway closure situations (use of the reminder)

As well as enforcing the use of the reminder by having air traffic controllers understand the importance of the reminder based on runway incursion incidents occurred at other airports, stipulating and circulating rules on the use of the reminder, and carrying out spot inspections, it also increased the size of the reminder and improved their visibility.
- (3) Elimination of unsafe elements involving work in the aerodrome
 - 1) Restrictions on work in the aerodrome

It stipulated that, in principle, only maintenance work on runway lights, runway centreline lights, precision approach path indicators and others, maintenance and management of aeronautical radio navigation facilities and others necessary for safe operation of aircraft would be undertaken during aircraft operating time.
 - 2) Certain comprehension and control of work in the aerodrome
 - a Contact to each control facility by the Operation Duty Officer

It arranged fax machines in each control facility (aerodrome, radar) and adopted a system for information sharing in order that the Operation Duty Officer could share approved work plans with each control facility. At the same time, it installed large work confirmation boards in the Operations Office, and adopted a system for the situation of each work activity to be managed unitary. Additionally, it also made improvements in order that notification could reliably be sent from the aerodrome control tower to the terminal radar control facility and the Operation Duty Officer at the beginning and end of work requiring entry to the runway.
 - b Instructions while work is in progress

The ATG stipulated and circulated the regulations that entry to the runway should be kept to the minimum necessary, that movement should use main traffic routes other

than the runway, that daytime (inspection) work should be undertaken by more than one person, that one person should always be in a position to monitor the vicinity and communicate with the control tower, and that when moving the work location, the instructions of the control tower should be confirmed each time.

3) Formulation of aerodrome zone (excluding apron zones) radio communication guidelines

To ensure the safety of the aerodrome, the new guidelines on radio communication was set between personnel and vehicles entering the aerodrome zone and the control tower.

(4) Operational management related to ATC implementation

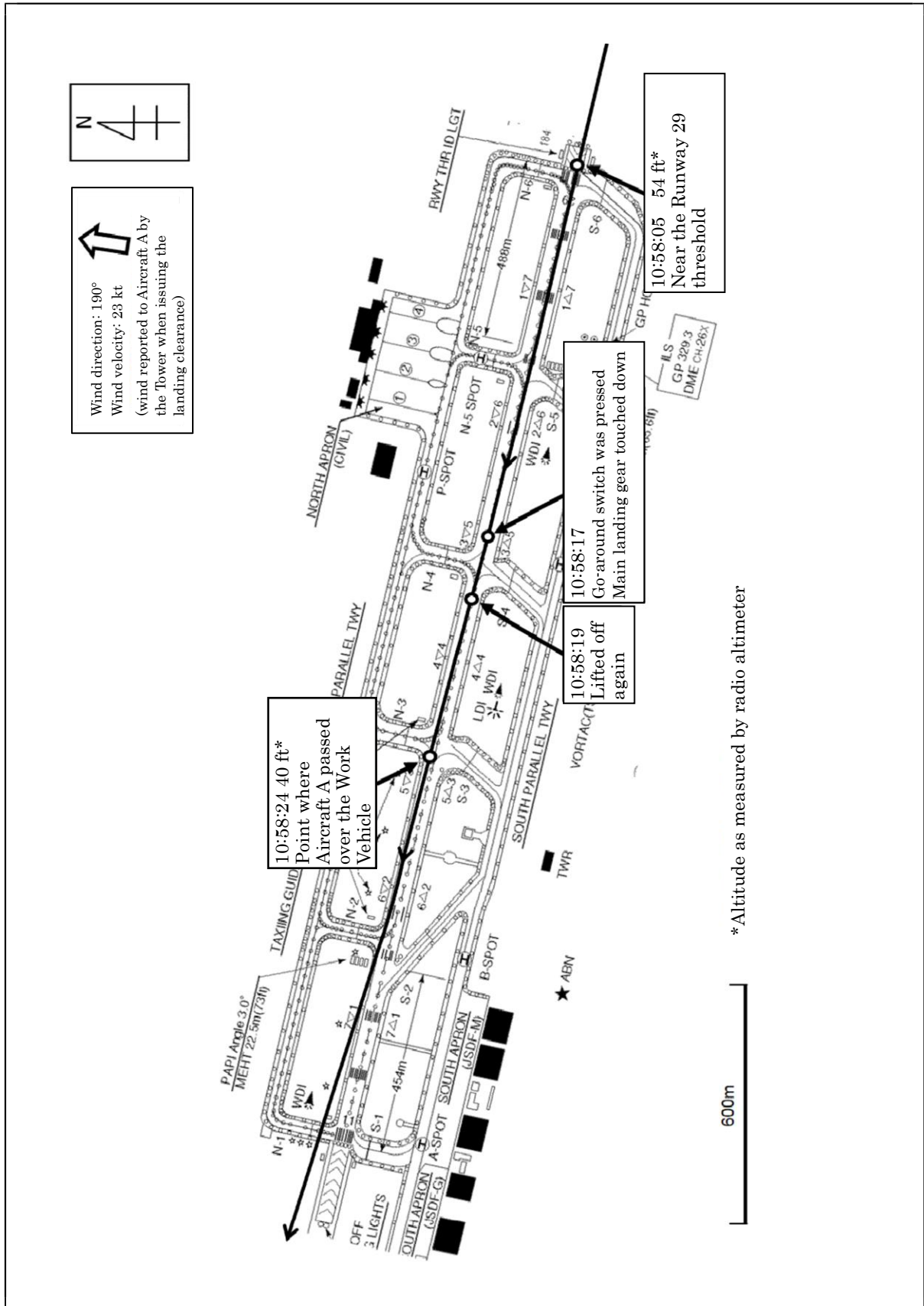
1) Minimum assignment of air traffic controllers

It stipulated that, when operating with reduced personnel due to the situation of air traffic and others, at least two air traffic controllers should be maintained in the control tower, even when temporarily leaving their seats, except when there are currently no aircraft being operated and none are scheduled during the time period concerned. It also stipulated that, when reducing personnel, a report to that effect should be made to the Operation Duty Officer.

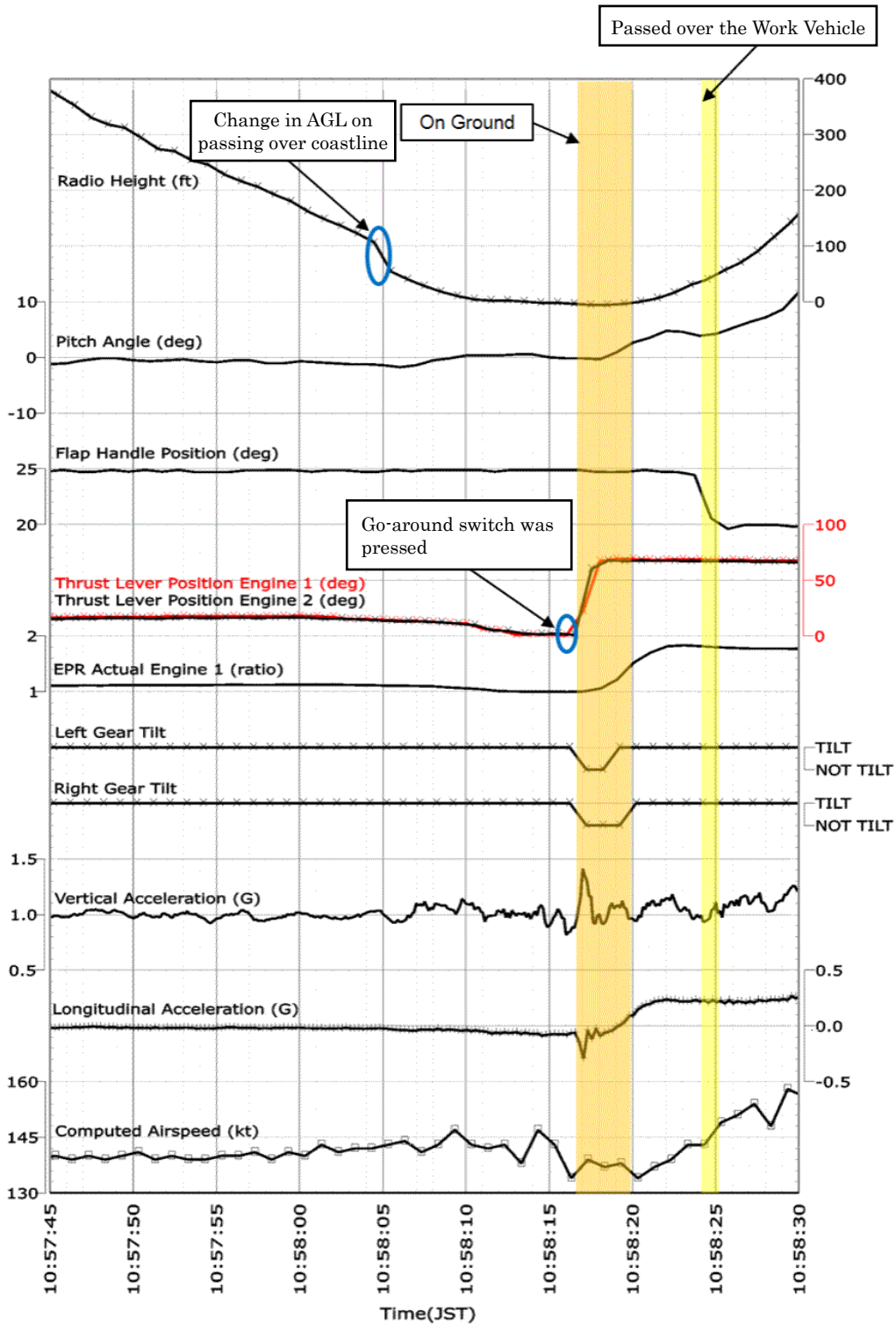
2) Confirmation of the knowledge and skills of air traffic controllers

It stipulated that, even when air traffic controllers satisfy the minimum standards for ATC implementation based on the Air Traffic Control Officer Examination Rules and internal rules, unless they have worked in ATC for a given period (the standard being at least one month), they can only be engaged in operations when it has been confirmed that they have the necessary knowledge and skills for ATC implementation.

Appendix Figure 1: Estimated Flight Path



Appendix Figure 2: FDR Records



Attachment: Classification of the Severity of Runway Incursions

The classification of severity relevant to the serious incident, according to ICAO Doc 9870 Manual on the Prevention of Runway Incursions, is as shown in the Table below.

Table 6-1 Severity Classification Scheme

<i>Severity classification</i>	<i>Description*</i>
<i>A</i>	<i>A serious incident in which a collision is narrowly avoided.</i>
<i>B</i>	<i>An incident in which separation decreases and there is significant potential for collision, which may result in a time-critical corrective/evasive response to avoid a collision.</i>
<i>C</i>	<i>An incident characterized by ample time and/or distance to avoid a collision.</i>
<i>D</i>	<i>An incident that meets the definition of runway incursion such as the incorrect presence of a single vehicle, person or aircraft on the protected area of a surface designated for the landing and take-off of aircraft but with no immediate safety consequences.</i>
<i>E</i>	<i>Insufficient information or inconclusive or conflicting evidence precludes a severity assessment.</i>

**Refer to Appendix 13 for the definition of "incident".*