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AIRCRAFT SERIOUS INCIDENT INVESTIGATION REPORT

ANA WINGS CO., LTD.

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February 22, 2018

JTSB Japan Transport Safety Board

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

OVERRUNNING
ANA WINGS CO., LTD.
BOMBARDIER DHC-8-402, JA461A
NEAR THE END OF THE RUNWAY 01R
AT NEW CHITOSE AIRPORT, HOKKAIDO, JAPAN
AT ABOUT 11:58 JST, JANUARY 19, 2017

January 26, 2018
Adopted by the Japan Transport Safety Board
Chairman Kazuhiro Nakahashi
Member Toru Miyashita
Member Toshiyuki Ishikawa
Member Yuichi Marui
Member Keiji Tanaka
Member Miwa Nakanishi

1. PROCESS AND PROGRESS OF INVESTIGATION

1.1 Summary of the Serious Incident	On Thursday, January 19, 2017, a Bombardier DHC-8-402 registered JA461A, operated by ANA Wings CO., LTD. took off from Akita Airport as a scheduled flight 1831 of ALL NIPPON AIRWAYS CO., LTD. as the joint undertaking for transport with ANA Wings, overran and came to a halt at the snow covered grassland at around 11:58 Japan Standard Time (JST: UTC +9 hours, all times are indicated in JST on a 24-hour clock) when landing at New Chitose Airport.
1.2 Outline of the Serious Incident Investigation	The occurrence covered by this report falls under the category of "Overrun (limited to when an aircraft is disabled to perform taxiing)" as stipulated in Clause 3, Article 166-4 of the Civil Aeronautics Regulations of Japan (Ordinance of Transportation No.56 of 1952), and is classified as a serious incident. On January 19, 2017, the Japan Transport Safety Board (JTSB) designated an investigator-in-charge and four other investigators to investigate this serious incident. An accredited representative and an adviser of Canada, as the State of Design and Manufacture, participated in the investigation. Comments were invited from the parties relevant to the cause of the serious incident and the relevant State.

2. FACTUAL INFORMATION

2.1 History of the Flight	Based on the records of Radar Tracks, multilateration system[1], Air Traffic Control communications and Flight Data Recorder (FDR), and according to the statements of flight crew of the aircraft and Air Traffic Controller, the history of the flight up to the serious incident is summarized below; On Thursday, January 19, 2017, a Bombardier DHC-8-402 registered JA461A, operated by ANA Wings CO., LTD. took off from Akita Airport as a scheduled flight 1831 of ALL NIPPON AIRWAYS CO., LTD. as a joint undertaking for transport with ANA Wings, heading to New Chitose Airport with 25 people in total onboard, consisting of a pilot in command (PIC), three other flight crew and 21 passengers. The PIC took the left hand pilot seat as the PF[2], and the co-pilot took the right hand seat as the PM[2]. The departure of the aircraft from Akita Airport was delayed for 15 minutes from the schedule because of one of two runways closed at New Chitose Airport due to a snow removal. The PIC had particularly checked the fallen snow condition at New Chitose Airport in details prior to his departure. The aircraft, after holding at NAVER (a waypoint at 35 NM south-southwest of New Chitose Airport), was vectored by the radar to ILS final approach course at Runway 01R of New Chitose Airport. Runway 01L/19R of the airport was closed due to a snow removal, and the aircraft was instructed to vacate the runway via Taxiway B2 connecting to the end of runway by the Aerodrome Control Facility. The PIC thought that the conditions of airflow and visibility caused no problem for the landing as he obtained the information of weather and braking actions of the runway during the flight and the weather was showing a sign of recovery trend. The PIC set flap at 15° and approached at the speed that was added to 10 kt to V_{REF} (Reference Landing Approach Speed) calculated at the condition. At 11:56:34, the aircraft touched down near the Touchdown zone marking at approximately 300 m from threshold at the speed of about 122 kt for airspeed (CAS) and about 107 kt for groundspeed (GS). A position of power lever (PL, see 2.7 (2)) was stable at the PL angle (PLA) at about 45°, till the touchdown (①, hereinafter same as the number of the appendix 1). As ground spoilers were automatically deployed right after the main gear touched down, PL transited to a point of the PL Flight position at about 42° of PLA and remained there for about 50

[1] "Multilateration System" is the system for identifying aircraft position using triangulation based on the time difference of arrival of signals at plural receivers including signals from the ATC transponder equipped on aircraft.

[2] PF (Pilot Flying) and PM (Pilot Monitoring) are terms used to identify pilots with their roles in aircraft operated by two persons. The PF is mainly responsible for maneuvering the aircraft. The PM mainly monitors the flight status of the aircraft, cross checks operations of the PF, and undertakes other non-operational works.

seconds (②). However, the PIC had a memory of his setting PL at Flight Idle position. The co-pilot confirmed that the light was on, which indicates the activation of ground spoiler. The co-pilot realized that the PIC was delaying the brake and thought that the propeller ground range advisory light (see 2.7 (2)) would not be on because of PL position.

The PIC judged that the aircraft would stop based on the runway condition. The PIC attempted to vacate the runway quickly by delaying the braking of the aircraft considering that the landing roll distance to

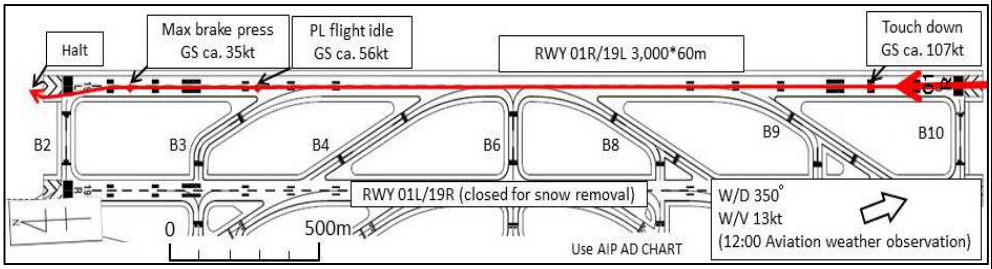

Figure 1 - Estimated flight route

Taxiway B2 was long, braking action[3] was Good and only one runway was in use.

The normal operations of the aircraft after the touchdown are setting PL at Flight Idle position, setting PL at Disc position and stepping on the brake. The PIC remembered that he had returned the PL to Disc position in somewhere, according to the FDR records, PL moved slowly to Flight Idle position for five seconds from 11:57:23 at about 56 kt GS near where the aircraft passed Taxiway B3 (③). The co-pilot was mainly watching the instrument panel and the heading direction on the runway, and did not have clear memory of PL position. When calling for 60 kt, the co-pilot thought that it could stop without overrunning.

The PIC remembered that he started to step on the brake from near Taxiway B4 considering the remaining distance, but the braking pressure actually started to rise as passing through Taxiway B3. The PIC did not feel the effect of braking, so he stepped on with maximum braking pressure, still he did not feel the deceleration, therefore he thought that the braking action was not good. However, because the warning light was not turned on, he did not think that equipment caused malfunctions. The braking pressure started to rise from 11:57:29 and became the maximum (3,000 psi) at about 35 kt for GS at about 200 m before the end of the runway. Because the co-pilot felt the braking of the aircraft, he judged that the PL was at Disc position and braking was operated and did not assist the brake. He thought that the weak deceleration was caused because the anti-skid system for braking did not work.

[3] "Braking action" is six-stepped classifications of friction factor on runway using the terms, "Good", "Medium to Good", "Medium", "Medium to Poor", "Poor", or "Very poor" from large value.

	From 11:57:11 to 11:57:35 during the landing roll, the co-pilot was performing the ATC communications. Depending on the snow-ice condition, the Reverse-pitch should be used with most care, therefore, the PIC did not use the Reverse-pitch in order to avoid a rapid deviation or lateral slip. The co-pilot recognized that the Reverse-pitch should not be used on the slippery runway, and thought that the PIC was considering the same. The PIC, judging that the aircraft was not decelerated enough to turn, used the pedal and steering hand-control to the left to avoid the overrun zone edge light which is not recessed type. The aircraft gradually decelerated, but passed through the end of the runway at about 20 kt GS and halted at the snow covered grassland at 11:58:07 without further deceleration. The right main landing gear was about 72 m from the runway end (about 12 m from the overrunning zone north end). There was almost no impact to stop. Right before the aircraft stopped (④), and after the conversation between the PIC and the co-pilot to check whether it could taxi or not (⑤), PL instantaneously moved more than 40°, and it moved to the Disc position at 11:58:37. The PIC reported to the ATC tower that the aircraft could not taxi, stopped the engine, instructed the status checking of the cabin and confirmed that there were no one injured.  Photo 1 - the aircraft which overran (Provided by the Civil Aviation Bureau) This serious incident occurred at 11:58 on January 19, 2017 near the end of Runway 01R (42° 47' 21" N, 141° 41' 28" E) of New Chitose Airport. (See Appendix 1 "FDR Records")
2.2 Injuries to persons	None
2.3 Damage to Aircraft	None
2.4 Personnel information	(1) PIC — Male, Age 52 Airline transport pilot certificate (Airplane) — November 6, 2012 Type rating for Bombardier DHC-8 — July 30, 2002 Class 1 aviation medical certificate Validity — April 20, 2017 Total flight time — 15,510 hours 06 minutes Flight time in the last 30 days — 39 hours 49 minutes Total flight time on the type of aircraft — 880 hours 27 minutes Flight time in the last 30 days — 39 hours 49 minutes

	(2) Co-pilot Male, Age 38 Commercial pilot certificate (Airplane) March 31, 2010 Type rating for Bombardier DHC-8 October 29, 2012 Instrument flight certificate (Airplane) November 11, 2010 Class 1 aviation medical certificate Validity March 25, 2017 Total flight time 2,880 hours 55 minutes Flight time in the last 30 days 55 hours 24 minutes Total flight time on the type of aircraft 2,541 hours 54 minutes Flight time in the last 30 days 55 hours 24 minutes
2.5 Aircraft information	Type: Bombardier DHC-8-402 Serial Number: 4430 Date of Manufacture: December 17, 2012 Certificate of Airworthiness: No. To-24-518 Validity: January 25, 2013 Category of Airworthiness Airplane Transport T Total flight time 8,833 hours 53 minutes The function test of the anti-skid system implemented right after the serious incident occurred was normal. As a result of the detailed inspection of the braking device after that, there was a problem that no electrical signal was output at the wheel speed transducer of the left inner main wheel which is a part of the anti-skid system, but there was no other abnormality.
2.6 Meteorological information	Aeronautical weather observations for the airport around the time of the serious incident were as follows; 11:30 Wind direction 340º; Wind velocity 15 kt; Visibility 10 km or more; Light shower snow Cloud: Amount 1/8, Type Stratus, Cloud base 500 ft Amount 3/8, Type Stratus, Cloud base 900 ft Amount 7/8, Type Cumulus, Cloud base 5,000 ft Temperature – 3 ºC; Dew point – 4 ºC Altimeter setting (QNH) 30.02 inHg 12:00 Wind direction 350º; Wind velocity 13 kt; Visibility 10 km or more; Light shower snow Cloud: Amount 2/8, Type Stratus, Cloud base 600 ft Amount 7/8, Type Cumulus, Cloud base 5,000 ft Temperature －2 ºC; Dew point –4 ºC Altimeter setting (QNH) 30.02 inHg
2.7Additional information	(1) Runway Condition with Snow Fall The assessment of the snow-ice to check runway condition with snow fall was carried out at 08:52, as the last one prior to the aircraft landing, the braking action at each of the three segments of the runway were Medium to good, Good and Good from the south-side and the percentage of snow/ice coverage for these parts were 80% or more. The assessment after the occurrence of the serious incident was carried out

at 12:21, each of braking actions were Good, Good and Medium to good from south-side and the percentage of snow/ice coverage were less than 40%, less than 60% and 80% or more.

According to a staff from the Civil Aviation Bureau, the runway condition after the occurrence of the serious incident was that the north-side had more snow than south-side. There were dry part and wet part because the snow was melting. The snow quality was compacted snow of "Wet Snow" which if the snow was squeezed, water would be dripped. The overrunning zone was not snow-removed like the runway, with snow and ice remaining.

Photo 2 - Condition of South-side runway (Pictured at the time of assessment after the occurrence of the serious incident)

Photo 3 - Condition of North-side runway (Pictured at the time of assessment after the occurrence of the serious incident)

(2) Braking System of the Aircraft

The braking systems of the aircraft are ground spoilers and propellers using air resistance, other than wheel brakes to brake the wheels, mechanically. The wheel brakes did not have an auto-brake function, but have anti-skid systems equipped. The ground spoilers deploy automatically after the touchdown of the main landing gears.

The propellers increase air resistance and obtain the braking force by overriding Flight Idle position with pulling triggers attached on PL and moving to Disc position having soft detent. In case that more braking force are required, it could decelerate by moving PL to Reverse position in order to generate backward thrust. When PL is between Flight Idle and Disc position and the blade angle is at 16° or less, the Propeller Ground Range Advisory light would be turned on.

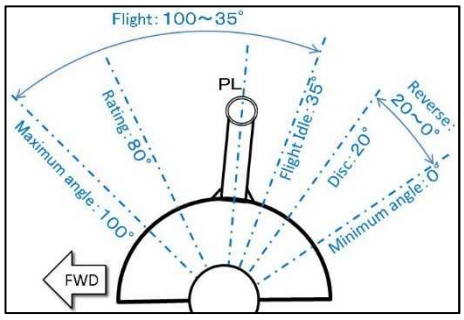

Figure 2 - PLA

(3) Operation of the Aircraft after the Touchdown based on the Company's Regulations

Aircraft operation manual (DHC-8-400AOM) of the company has the following descriptions (excerpts):

3-1-1 GENERAL

This section describes the standard Normal Procedure required for

the effective and safe flight of the DHC 8-400 model plane. Carry out All of Normal Procedure at Memory and then by performing Normal Checklist, and reconfirm that the particularly important items are completed. (Omitted) Depending on the flight situation, even when the PIC changed who is in charge of piloting, period of implementing the operation, configurations and speed based on the judgment of the PIC, flight crew should confirm the completion of each operating item of being carried out for sure based on assigned role which is stipulated in this section.

3-9-3 LANDING ROLL PROCEDURE

PF	*PM*
POWER Levers ----- FLT IDLE	
POWER Levers----------DISC BRAKE ---------- APPLY	*Monitor Engine Instruments. Confirm that PROPELLER GROUND RANGE Advisory Light can be on.*
	At same time with the touchdown of Main Wheel, confirm that ROLL OUTBD and ROLL INBD SPOILER Advisory Light can be on.
Apply Forward Pressure on Control Wheel at the same time as the touchdown of the Nosewheel.	
	Call "Sixty" when reaching 60 kts.

NOTE: Use Reverse Pitch as required. Then, pay enough attention to Directional Control.

4-3-3 LANDING ON SLIPPERY RUNWAYS

TOUCHDOWN AND LANDINGROLL

Once touched down, it is important to carry out all operation in quick and appropriate manner in order to stop aircraft. An appropriate operation of the following procedures can stop aircraft within a shortest distance.

(Omitted)

Avoid to apply Reverse at a slippery runway except when required. When Reverse is applied on a slippery runway at crosswind situation, consider possibilities of aircraft flowing to the lee. When correcting to return to a runway centerline, first advance power level to Flight Idle position, release a brake and as directional control is recovered, apply more brake and select Disc position. Unless forced by requirement, do not select Reverse Thrust.

(4) Landing Performance of the Aircraft

At the occurrence of the serious incident, based on the weight (51,820 lbs) of the aircraft, the weather (head wind; 13 kt), the runway

	length (3,000 m), the braking actions of the runway (Medium to good) and an altitude above sea level (57 ft), V_{REF} and the required landing distance calculated derived from AOM were as follows. V_{REF}: 115 kt Required landing distance: 1,311 m (5) Calculation of Friction Coefficient The friction coefficient of the runway and overrunning zone while applying maximum brake pressure was calculated to be 0.19 based on the information of FDR and Quick Access Recorder (QAR) by the design-manufacturer, and this was a value corresponding to Medium braking action.

3. ANALYSIS

3.1 Involvement of weather	Yes
3.2 Involvement of pilot	Yes
3.3 Involvement of equipment	None
3.4 Analysis of known items	(1) Braking Systems It is highly probable that the braking systems of the aircraft was acting normally at the time of the serious incident, because the function test implemented right after the serious incident occurred was normal, though a wheel speed transducer had a malfunction according to the detailed inspection. (2) Landing Performance of the Aircraft Based on the required landing distance of the aircraft, it is highly probable that if the aircraft was operated as AOM right after the touchdown, it could stop inside of the runway with enough margin. (3) Braking Action during Braking Operation The braking action (Medium) corresponding to the friction coefficient 0.19 of the runway and the overrunning zone during the braking operation calculated by the designer / manufacturer was worse than the braking action (Medium to good) measured after the serious incident occurred. This is probable that it was caused because the place where the braking operation was performed was including the overrunning zone with no grooving and without snow-removed like the runway. It is probable that the snow fallen conditions near the end of the runway and the overrunning zone where the maximum brake pressure was applied by the aircraft. (4) Operation after the Touchdown of the Aircraft It is certain that as the aircraft touched down at about 122 kt for CAS, about 107 kt for GS and about 45 ° for PLA near the Touchdown zone marking at approximately 300 m from threshold of Runway 01R of

New Chitose Airport and deployed the Ground Spoiler right after the touchdown.

It is highly probable that because the PIC was instructed to vacate the runway to Taxiway B2 at the end of the runway, he attempted to delay the braking of the aircraft. It is probable that he moved PL to the 42° PLA position which is one of the Flight position and kept there for about 50 seconds, and during this time he mistook PL was already Flight Idle position.

At the point when the aircraft was passing through Taxiway B3, it is highly probable that PL moved slowly to Flight Idle position and the braking pressure started to rise, because the PIC started to operate the braking. Though the PIC thought that he attempted to start the braking operation at Taxiway B4 by considering the remaining distance, it is probable that he mistook Taxiway B3 for Taxiway B4. It is highly probable that the reason why he did not feel the braking effect even though he started to step on the brake pedal was that there was no braking effect obtained from the propeller because the PL was at Flight Idle position. Moreover, it is probable that the bad conditions with snow fall around the end of the runway and the overrunning zone contributed to the braking effect. Regarding why the braking pressure of the aircraft became the maximum pressure after that; it is probable that because the PIC mistook that PL was at Disc position, and he tried to obtain the braking effect only by operating the brake.

Right before the aircraft stopped, it is somewhat likely that the spontaneous move of PL for more than 40° was connected with forward move of the PIC body by the impact caused by the stop of the aircraft. After the conversation between the PIC who saying that he would check the aircraft could taxi and the co-pilot, it is somewhat likely that the spontaneously movement of PL for more than 40° could be caused by the PIC who might move the PL to check the ability of aircraft to taxi.

(5) Overrun

Regarding why the aircraft overrun, it is highly probable that because the aircraft could not obtain the braking force due to the delay of braking operation start by the PIC and PL was not set at the Disc position during the time from braking operation start to the aircraft stop. Moreover, it is probable that the bad conditions with snow fall around the end of the runway and the overrunning zone contributed to the aircraft overrunning.

(6) Delay of Braking Operation Start

Regarding the delay of braking operation start by PIC, it is highly probable that because the PIC instructed from ATC to vacate from Taxiway B2 at the end of the runway tried to vacate the runway in a short time by delaying the braking operation start and high speed rolling on the runway. In general, at airports with heavy traffic, efforts are made to get out of the runway promptly after landing, but it was not necessarily

	appropriate for a slippery runway in winter. Furthermore, it is probable that the PIC's misconceiving Taxiway B3 where he just started to vacate as Taxiway B4 contributed to it. (7) Operation of PL Regarding why the PL was not set to Disc position, though the mechanism was difficult to make a mistake by the trigger and soft detent, it is probable that the PIC mistook the PL position during the time from touchdown to stop of the aircraft and did not check it in the meantime. AOM explains about an operation after the landing on slippery runway as "once touched down, it is important to carry out all operations in speedy and appropriate manner". It is somewhat likely that the PIC was able to perform a reliable operation by performing a series of operations described in the AOM right after the touchdown and starting taxi again after decelerating to the taxi speed. Furthermore, it is probable that the co-pilot did not realize that the intention of the PIC differed from what he did. Based on these, it is somewhat likely that the fact that the captain was not expressing his intention clearly contributed to it. (8) Operation of Reverse Pitch It is somewhat likely that the overrun could be avoided by setting PL at Disc position or appropriate use of Reverse pitch. Regarding the operation on a "slippery runway" after the touchdown, AOM describes that "Avoid to use a Reverse pitch on a slippery runway except when necessary" and "under the crosswind condition, do not select Reverse thrust unless facing the need", but it is somewhat likely that using the reverse pitch appropriately should be reviewed.

4. PROBABLE CAUSES

In this serious incident, it is highly probable that the aircraft overran the runway because the aircraft could not obtain the braking force due to the delay of braking operation start by the PIC and PL (Power Lever) was not set at the Disc position. Moreover, it is somewhat likely that the bad conditions with snow fall around the end of the runway and the overrunning zone contributed to the aircraft overrunning.

Regarding the delay of braking operation start by the PIC, it is highly probable that because the PIC instructed from ATC to vacate from Taxiway B2 at the end of the runway tried to vacate the runway in a short time by delaying the braking operation start. Furthermore, it is probable that the PIC's misconceiving Taxiway B3 where he just started to vacate as Taxiway B4 contributed to it.

Regarding why the PL was not set to Disc position, it is probable that because the PIC mistook the PL was already Disc position. Furthermore, it is somewhat likely that it was contributed that the co-pilot did not notice PL in different position than normal.

5. SAFETY ACTION

The company took the following actions after this serious incident.

(1) The company reminded all flight crew about the study of this case and notifying the safety action for similar events for three times, on January 19, January 24 and February 3, 2017.

(2) Aiming the safety ensuring (matching the recognition of the situation concerning the PL operation between PF and PM during the landing roll and reliable operation of PL to the Disc position) during the flight on Winter season, the operation as a campaign with the following contents was started from February 22, 2017, and the AOM was revised to reflect this contents on June 8, 2017. Furthermore, the information with contents of "set Power Lever to Disc position promptly right after the nose wheel touchdown" was issued on May 25, 2017.

Content;

Aiming to set PL to the Disc position promptly after the touchdown, and to operate reliably based on the mutual recognition of PF and PM, the following callout was carried out.

PF	PM
Set Power Lever to Disc position and call "Disc".	Call "Ground Range" when either of Propeller Ground Range Advisory Light flash. Call "No Ground Range" in case of no flash of Propeller Ground Range Advisory Light.

(3) On August 6, 2017, the in-house magazine titled as "For the flight during the winter season (2017~2018): Prevent Overrunning" was issued to all flight crews, and the winter operation training for the fiscal year of 2017 was commenced from August 6, 2017. And the safety action to prevent occurring the similar event during winter season was reminded in this document by emphasizing to carry out prompt operation after touchdown and do not over-trust the brake.

(4) In order to introduce a training to experience reverse pitch operation, a training manual was revised to carry out simulator training for PIC appointment/promotion and co-pilot appointment and periodic simulator training regarding to same type aircraft with the aircraft on July 3, 2017, and the training based on this manual was started on July 6, 2017.

Appendix 1: FDR Records