

AA2016-6

**AIRCRAFT ACCIDENT
INVESTIGATION REPORT**

**JAPAN COAST GUARD
J A 7 2 7 B**

July 28, 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 determine the causes of an accident and damage incidental to such an accident, thereby preventing future accidents and reducing damage. 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 ACCIDENT INVESTIGATION REPORT

DAMAGE TO THE AIRFRAME DURING LANDING JAPAN COAST GUARD, BOMBARDIER DHC-8-315, JA727B SENDAI AIRPORT AT ABOUT 15:58 JST, MAY 30, 2015

June 24, 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

1 PROCESS AND PROGRESS OF THE ACCIDENT INVESTIGATION

On June 4, 2015, the Japan Transport Safety Board received the report of the accident and designated an investigator-in-charge and an investigator to investigate this accident. An accredited representative of Canada as the State of design and manufacture of the aircraft involved in this accident, participated in the investigation.

Comments were invited from parties relevant to the cause of the accident and the relevant State.

2 FACTUAL INFORMATION

2.1 History of the Flight

On Saturday, May 30, 2015, a Bombardier DHC-8-315, registered JA727B, operated by Japan Coast Guard, touched down on the runway with strong impact against the nose landing gear, causing the damage of the airframe, in landing on Sendai Airport (hereinafter referred to as "the Airport"). Although the captain, the trainee, and crew members (the total of eight people) were on board, there were no dead or injured.

According to the statements of the captain and the trainee, and the records of the flight data recorder (hereinafter referred to as "FDR") and the cockpit voice recorder (hereinafter referred to as "CVR"), the history of the flight is summarized as follows.

At 13:58, the aircraft took off from Hanamaki Airport, operated by the trainee, with the captain who is an instructor on the right seat and the trainee on the left seat for training flight for obtaining the type rating related to First Officer certification in the Japan Coast Guard. After the aircraft conducted touch-and-goes training repeatedly at Hanamaki Airport, the aircraft conducted emergency procedure training in the high altitude training / testing area for Japan Self-Defense Force aircraft (D-1)

located southeast of Hanamaki Airport, and went towards the Airport in order to conduct flap up landing (landing with flap of 0°) which was the last training subject on that day.

The captain and the trainee completed the flap up landing checklist just before the arrival of Yuriage (a visual reporting point of the Airport), and the captain told the trainee that if the pitch angle (nose-up angle) exceeded 6°, corrective control would have to be performed by pushing the control column forward. V_{ref} (reference speed for landing) was decided to 126 kt. The aircraft entered the traffic pattern of runway 09 of the Airport and made landing with landing clearance at around 15:58.

Although the trainee made the main landing gear touch on the ground near the aiming point marking for the runway 09 in landing, he felt it took a great deal of time to lower the nose. This time the captain on the right seat felt that the nose would up higher than the attitude with which the main landing gear touched the ground, and pushed the control column forward considering worry of tail contact (the contact of the after lower part of the fuselage against the surface of the runway), then the nose landing gear touched the ground with stronger impact than usual. Both of the captain and the trainee were not aware of irregularity of the aircraft in landing roll, therefore they continued taxi and the aircraft arrived at apron at around 16:05.

After the engines were shutdown, the nose landing gear was found to be damaged in post-flight inspection by on-board mechanic. Afterward, detailed inspection was conducted, which revealed abrasion marks on the lower part of the nose landing gear, damage on components of the nose landing gear, and deformation of the forward fuselage skins of the airframe. It is considered possible from the abrasion marks of the components of the lower part of nose landing gear that the aircraft might come in contact with the runway, therefore the runway inspection was conducted by Japan Civil Aviation Bureau and abrasion marks were found, which seem to be caused by the contact of the aircraft part.

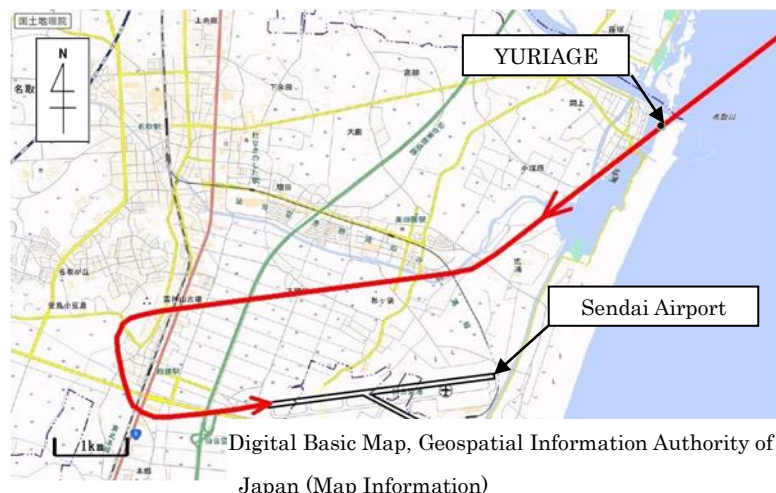


Figure 1 Estimated approach route

	<p>According to the records of FDR and CVR, the pitch angle started to be moved upward at around 15:58:21 and the elevator angle was changed to the nose-down direction from the time when the pitch angle exceeded 6°. At around 15:58:23, the pitch angle started to be moved downward and continued moving downward after the main landing gear touched the ground at around 15:58:24, then at around 15:58:25, the nose landing gear touched the ground once. The elevator angle was changed to the nose-up direction again soon before the nose landing gear touched the ground, and the pitch angle was moved upward after the nose landing gear touched the ground once. At around 15:58:27 when the pitch angle exceeded 3.5°, the elevator angle was largely changed to the nose-down direction and at around 15:58:28, the nose landing gear touched the ground again. The recorded value of vertical acceleration (G) of this time was +1.47. In addition, impact sounds were recorded in CVR.</p>
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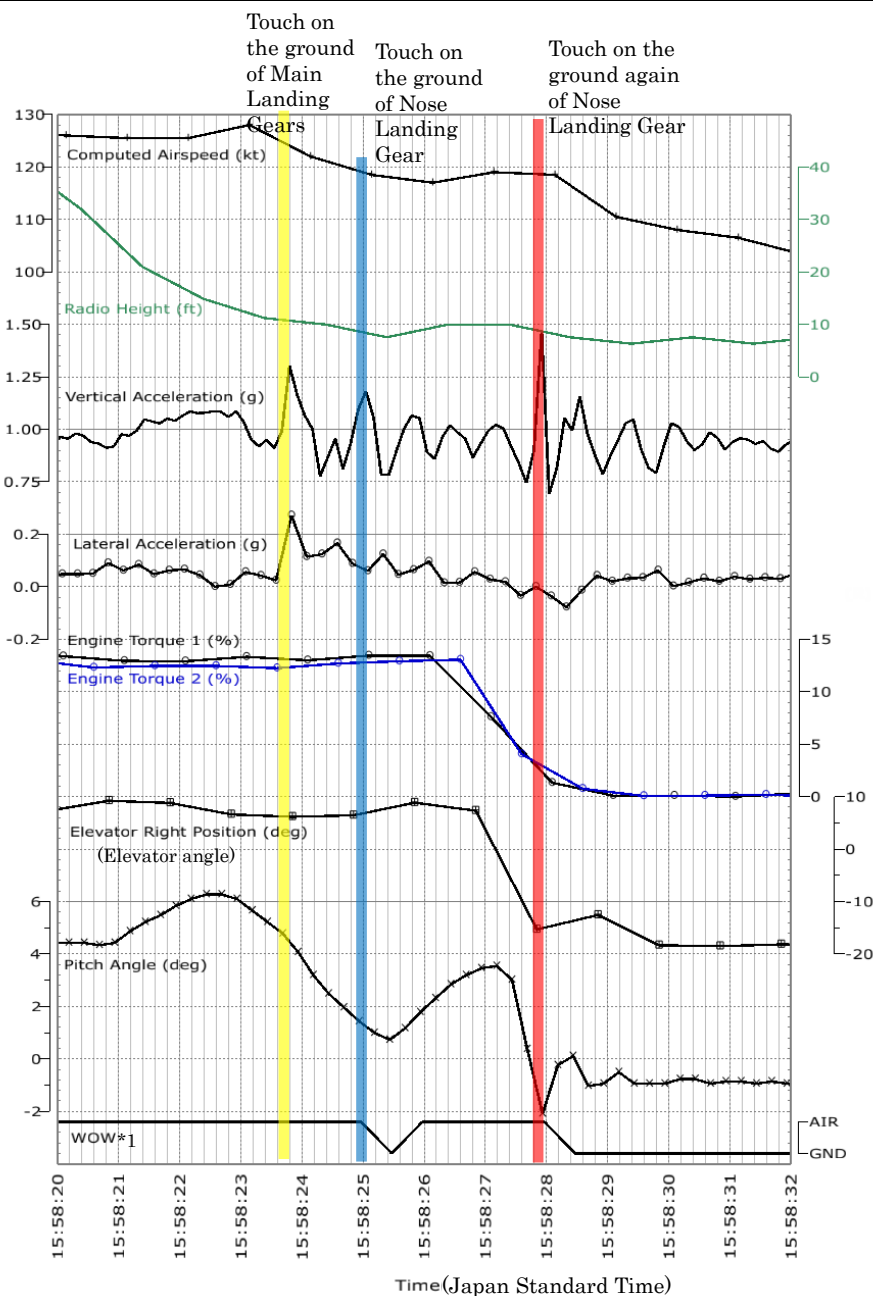


Figure 2 FDR records during the time of the accident

<p>2.2 Injuries to Persons</p>	<p>None</p>
<p>2.3 Damage</p>	<p>Extent of damage of the aircraft : Substantially damaged</p> <ul style="list-style-type: none"> • Nose landing gear The bottom of strut was partly attrition, components of shock strut were broken and deformed marks of both tires. • Fuselage Left and right fuselage skins of the airframe were deformed in the rear of the nose landing gear mounting areas.

*1 "WOW: Weight On Wheel" refers to the data recorded in FDR by signals from a sensors which works if loads are put on each landing gear. In the case of the aircraft, "GND" is recorded in FDR if loads are put on all of the nose landing gear and main landing gears, and "AIR" is recorded if loads are not put on one of landing gears, even if a remaining landing gear touches down and enough load is put.



Photo 1 The aircraft



From the forward lower part of the nose landing gear

Abrasion status of the lower part of strut for the nose landing gear



From the rear of the nose landing gear

Damage condition of components of shock strut for the nose landing gear



Right tire of nose wheel

Deformed marks on tire



Right forward airframe

The deformation to the airframe

2.4 Personnel Information

(1) Captain (instructor) Male, Age 45
 Commercial pilot certificate (airplane) January 27, 1994
 Type rating for Bombardier DHC-8 November 11, 2010
 Class 1 aviation medical certificate
 Validity June 3, 2015
 Total flight time 4,659 hr 57 min
 Flight time for the last 30 days 34 hr 35min
 Total flight time on the type of aircraft 1,617 hr 00 min
 Flight time for the last 30 days 14 hr 15 min
 Flight instructor certificate
 The captain had an instructor certificate (a certificate which is valid only in Sendai air base).
 The flight on the day of the accident was the first training flight for the captain after he was certified to be an instructor in Sendai air base.
 Total flight time as instructor in other air bases 20 hr 50 min

	<p>(2) Trainee Male, Age 32</p> <p>Commercial pilot certificate (airplane) December 24, 2010</p> <p>Type rating for multi-engine (land) December 28, 2009</p> <p>Class 1 aviation medical certificate</p> <p>Validity January 13, 2016</p> <p>Total flight time 530 hr 04 min</p> <p>Flight time for the last 30 days 4 hr 00 min</p> <p>Total flight time on the type of aircraft 15 hr 50 min</p> <p>Flight time for the last 30 days 4 hr 00 min</p>
2.5 Aircraft Information	<p>(1) Type of aircraft: Bombardier DHC-8-315</p> <p>Serial number: 586, Date of manufacture: June 9, 2002</p> <p>Certificate of Airworthiness No. TO-26-564, Validity: March 4, 2016</p> <p>Category of airworthiness Airplane transport T</p> <p>Total flight time 16,204 hr 15 min</p> <p>(2) When the accident occurred, the weight of aircraft was estimated to have been 36,015.9 lb and the position of the center of gravity is estimated to have been 21.8 % mean aerodynamic chord (MAC^{*2}). Both of them were estimated to have been within the allowable ranges.</p>
2.6 Meteorological Information	<p>(Observation records at the Airport and the statements of crews in the aircraft)</p> <p>Aerodrome routine meteorological report (15:00)</p> <p>Wind direction 140°, Wind velocity 8 kt, Prevailing visibility 35 km</p> <p>Cloud Amount FEW 1,000 ft (Stratus), Temperature 22°C,</p> <p>Dew-point 16°C, Altimeter setting (QNH) 29.51 inHg</p> <p>While the aircraft was flying in the traffic pattern, wind direction/wind velocity reported from the tower to the aircraft were 150°/08 kt.</p>
2.7 Additional Information	<p>(1) Information on flight recorder</p> <p>The aircraft was equipped with U.S. Honeywell's FDR which can retain about 25 hours data and U.S. Honeywell's CVR which can retain about 2 hours data, both of which retained the records when the accident occurred.</p> <p>The time calibration for the flight recorder was performed by making time signals recorded in the air traffic control communication records correspond to VHF wireless transmission signals and air traffic control communication recorded in the flight recorder.</p> <p>(2) Information of accident site</p> <p>The runway 09 in the Airport where the accident occurred is 3,000 m in length and 45 m in width and had scratched marks of about 2.2 m in length at about 743 m from the runway 09 threshold and about 5 m right side (south) of the runway center line in the approach direction.</p>

^{*2} "MAC" refers to the abbreviation Mean Aerodynamic Chord. It is a wing chord that represents the aerodynamic characteristic of the wing, and indicate the average of when the wing chord such as the rear wing chord is variable. 21.8 % MAC indicates a 21.8 % position from the front of the mean aerodynamic chord.

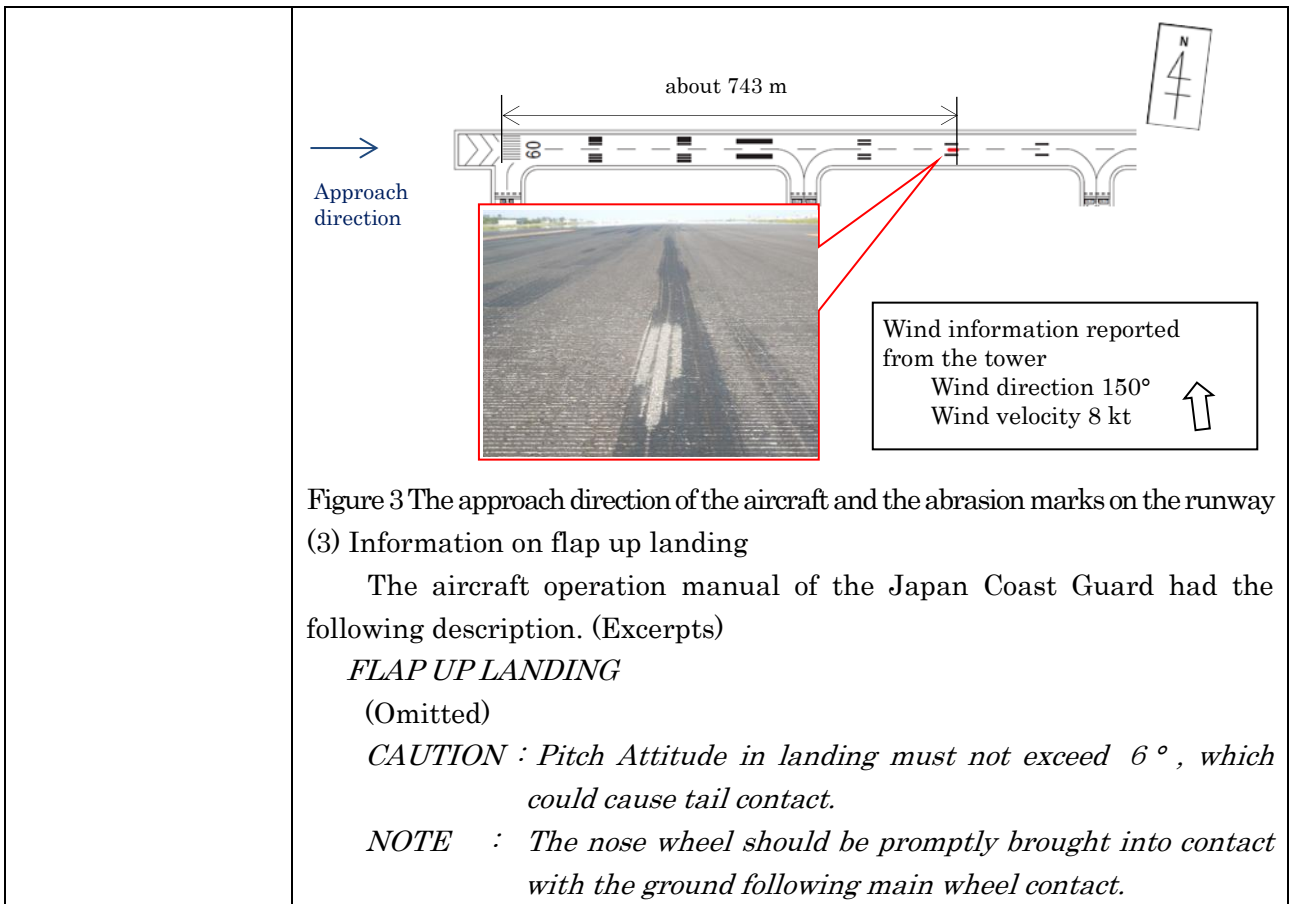


Figure 3 The approach direction of the aircraft and the abrasion marks on the runway

(3) Information on flap up landing

The aircraft operation manual of the Japan Coast Guard had the following description. (Excerpts)

FLAP UP LANDING

(Omitted)

CAUTION : Pitch Attitude in landing must not exceed 6 ° , which could cause tail contact.

NOTE : The nose wheel should be promptly brought into contact with the ground following main wheel contact.

3 ANALYSIS

3.1 Involvement of Weather	No
3.2 Involvement of Pilots	Yes
3.3 Involvement of Airplane	No
3.4 Analysis of Findings	<p>(1) Analysis of weather</p> <p>When the accident occurred, 8 kt steady wind blew from the direction of 150° in the Airport. The direction of the landing runway is 09 of the Airport; therefore, it is probable that the aircraft was exposed to the wind from the right direction of about 60°. The crosswind component is about 7 kt this time and there is no information such as gusts in the report and statements; therefore, it is highly probable that the weather at the time of the accident did not affect landing control of the aircraft.</p> <p>(2) Situation from main landing gear touch on the ground up to nose landing gear touch on the ground</p> <p>Based on FDR records and the statements of the captain and the trainee, after the main landing gear of the aircraft touched the ground the nose landing gear touched the ground once; however, the elevator angle was changed to the nose-up direction by supporting the control column (the control for moving the nose downward gently) just before the nose landing gear touched the ground. Afterward, the nose started to up again due to the</p>

	<p>delay of control to loosen the support for the control column and the reaction from touch on the ground of the nose landing gear, and it is probable that the control for moving the nose downward was performed at the time when the pitch angle exceeded about 3.5°.</p> <p>(3) Control of the aircraft in nose landing gear touch on the ground again</p> <p>Based on FDR records and the statements of the captain and the trainee, the nose landing gear touched the ground once and the nose has begun to nose up again, thereafter, the control column was pushed for about one second until the nose landing gear retouched the ground and the elevator angle was largely changed from +7° through -15° in the one second. It is probable that this was because the captain who considered worry of tail contact pushed the control column forward. It is probable that this sudden and large control for moving the nose downward made the nose landing gear strongly retouch on the ground and causing the damages of the nose landing gear and the forward fuselage skins of the fuselage. The value of maximum G (vertical acceleration) at this time was recorded to be +1.47.</p>
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4 PROBABLE CAUSES

<p>In this accident, it is probable that the nose of the aircraft suddenly downed and the nose landing gear strongly touched down on the ground after the main landing gear touched the ground in the landing, therefore the components of the nose landing gear were damaged and the fuselage skins of the airframe was deformed.</p> <p>Regarding the fact that the nose landing gear of the aircraft strongly touched the ground on the ground, it is probable that it was because that the captain who considered worry of tail contact performed the sudden and large control for moving the nose downward, when the nose-up attitude tended to be too excessive after the nose landing gear touched the ground once and the nose upped again.</p>
