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

<table>
<thead>
<tr>
<th>2.1 History of the Flight</th>
</tr>
</thead>
</table>

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 a 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](image)

Figure 1 Estimated approach route
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.
2.2 Injuries to Persons

None

2.3 Damage

- Extent of damage of the aircraft: Substantially damaged
  - 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.
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 35 min
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
(2) Trainee  Male, Age 32
Commercial pilot certificate (airplane)  December 24, 2010
Type rating for multi-engine (land)  December 28, 2009
Class 1 aviation medical certificate
Validity  January 13, 2016
Total flight time  530 hr 04 min
Flight time for the last 30 days  4 hr 00 min
Total flight time on the type of aircraft  15 hr 50 min
Flight time for the last 30 days  4 hr 00 min

2.5 Aircraft Information
(1) Type of aircraft: Bombardier DHC-8-315
   Serial number: 586,  Date of manufacture: June 9, 2002
   Certificate of Airworthiness No. TO-26-564,  Validity: March 4, 2016
   Category of airworthiness  Airplane transport T
   Total flight time  16,204 hr 15 min
(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.

2.6 Meteorological Information
(Observation records at the Airport and the statements of crews in the aircraft)
   Aerodrome routine meteorological report (15:00)
   Wind direction 140°, Wind velocity 8 kt, Prevailing visibility 35 km
   Cloud Amount FEW 1,000 ft (Stratus), Temperature 22°C,
   Dew-point 16°C,  Altimeter setting (QNH) 29.51 inHg
   While the aircraft was flying in the traffic pattern, wind direction/wind velocity reported from the tower to the aircraft were 150°/08 kt.

2.7 Additional Information
(1) Information on flight recorder
   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.
   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.
(2) Information of accident site
   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.

\(^2\) "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 | (1) Analysis of weather

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.

(2) Situation from main landing gear touch on the ground up to nose landing gear touch on the ground

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
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°.

(3) Control of the aircraft in nose landing gear touch on the ground again

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 $+7^\circ$ through $-15^\circ$ 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 $+1.47$.

4 PROBABLE CAUSES

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.

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.