

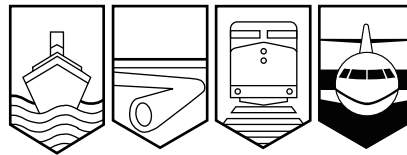
Transportation Safety Board
of Canada



Bureau de la sécurité des transports
du Canada

AVIATION INVESTIGATION REPORT

A01H0004



LANDED BESIDE RUNWAY

AIR CANADA REGIONAL AIRLINES

DE HAVILLAND DHC-8-100 C-FDND

PEACE RIVER, ALBERTA

24 OCTOBER 2001

Canada

The Transportation Safety Board of Canada (TSB) investigated this occurrence for the purpose of advancing transportation safety. It is not the function of the Board to assign fault or determine civil or criminal liability.

Aviation Investigation Report

Landed Beside Runway

Air Canada Regional Airlines
De Havilland DHC-8-100 C-FDND
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Report Number A01H0004

Summary

Air Canada Region Airlines Flight CDR8321, a de Havilland DHC-8-100, C-FDND, departed Edmonton International Airport, Alberta, at 0800 mountain daylight time on an instrument flight rules (IFR) flight to Peace River. There were three crew members and eight passengers on board. The crew conducted a VOR/DME approach to Runway 22 and, shortly after crossing the final approach fix, sighted what they believed to be the runway. At 0907, the aircraft touched down in a grassy area 151 feet to the right of the runway and 1900 feet beyond the runway threshold. The flight service station (FSS) specialist noticed the aircraft landing beside the runway and instructed the flight to go around. The crew initiated a go-around, and the aircraft became airborne after travelling along the ground for a distance of 1300 feet. After holding in the vicinity of the airport for about one hour, and after making a second, unsuccessful approach to Runway 22, the crew returned to Edmonton where the flight landed safely. There was no damage to the aircraft; no one was injured.

Other Factual Information

The flight was preceded by a crew rest period of approximately 10 hours; the captain had slept about seven hours and the first officer about eight hours. The pilots' flying schedules and activities prior to the flight were not conducive to fatigue, and they both indicated that they felt well rested.

The flight was the first leg of a planned series. The flight to Peace River was routine and the first officer was the pilot flying. At 0840, the latest Peace River weather information was passed to the crew by the Peace River FSS specialist. The weather for 0800¹ was reported as follows: winds calm; visibility 15 statute miles; clouds broken ceiling at 400 feet above ground level (agl) and overcast at 800 feet agl; temperature minus 4°C; dew point minus 5°C; altimeter 29.87 inches of mercury; clouds stratus 6/8 and stratus 2/8. At 0851, the crew was informed that Runway 22, the active runway, was 100 per cent snow covered to a depth of ¼-inch and had been sanded. They were also informed that at 0623 that morning, with a temperature of minus 5°C, the Canadian runway friction index (CRFI) for Runway 22 had been 0.37. This same information concerning the runway surface condition and CRFI was provided to the crew in their pre-flight documentation. The first officer briefed the captain on the approach that he intended to conduct. His briefing did not address the issue of runway visibility in the existing conditions.

At 0852, the Peace River FSS specialist requested that CDR8321 provide a pilot report (PIREP) on the cloud tops and cloud bases on the approach. At 0855, CDR8321 was informed that the weather at 0849 was as follows: winds calm; visibility 10 statute miles in light snow; clouds 400 feet agl scattered and 1500 feet agl overcast; stratus 4/8 stratocumulus 4/8.

The aircraft followed the 15 DME arc for the VOR/DME approach to Runway 22. With the autopilot engaged and coupled to the VOR, the aircraft intercepted and followed the final approach course. Just prior to crossing the XEVER final approach fix, CDR8321 reported the cloud tops to the FSS specialist as 2600 feet above sea level (asl). Inside the XEVER, at a distance of about two miles back from Runway 22, both pilots spotted what they believed to be the runway. The first officer informed the captain that he had the runway in sight, then disengaged the autopilot and leveled the aircraft at the minimum descent altitude of 2200 feet asl. The crew reported the cloud base to the FSS specialist as 2300 feet asl. The first officer then saw the precision approach path indicator (PAPI) lights for Runway 22, which appeared red over red. At about a mile back from the runway, the aircraft intercepted the PAPI glide path and the first officer followed the glide path down toward the runway. The first officer saw what he believed to be the snow-covered runway threshold and, following a brief discussion with the captain, decided to land just beyond it. At about this time, the FSS specialist noted that the aircraft appeared to be high and landing long. At 0906, the aircraft touched down on a snow-covered, grassy area, 150 feet to the right of the runway and 1900 feet beyond the runway threshold. The first officer brought the power levers to the idle position and lowered the nose wheel to the ground. At this time, the FSS specialist saw the aircraft landing beside the runway and instructed the flight to go around. Three seconds after the aircraft had touched down, propeller RPM and torque started to rise as a go-around was initiated by the first officer. Eight seconds after touchdown, the aircraft became airborne after traveling a distance of 1300 feet along the ground.

¹ All times are MDT (Coordinated Universal Time minus six hours) unless otherwise noted.

The flight crew requested another approach to Runway 22 and were subsequently cleared to hold. They questioned the FSS specialist on the instruction to go around and were informed that they had landed on the grass beside Runway 22. They expressed surprise and asked if the runway was snow-covered. The FSS specialist informed the crew that the runway was snow-covered and that the grassy area beside the runway was darker. The flight crew requested that the runway threshold be cleared of snow so they could identify it more easily. A 20-foot swath was cleared down the centre of the runway and the threshold area was also cleared of snow. A second approach was conducted with the captain flying the latter part of the approach and with the runway lights on the highest intensity setting. The crew saw the ground and the runway lights; however, they did not land because they had not seen the runway environment in time to conduct a stabilized approach and landing. At 0959, CDR8321 called the missed approach. The reported ceiling at 1000 was 400 feet agl and the visibility was five statute miles in light snow. The flight subsequently diverted to Edmonton where it landed safely.

Comments concerning the runway environment were obtained from pilots who had landed on Runway 22 before and after CDR8321. The first officer of a flight that landed at 0747 that morning recalled only that the runway had some snow on it. The first officer of a flight that landed at 1032, after the 20-foot wide swath had been cleared down the centre of the runway, commented that the cleared area made the runway look very obvious, and that without it, it would not be hard to mistake the grass area for the runway.

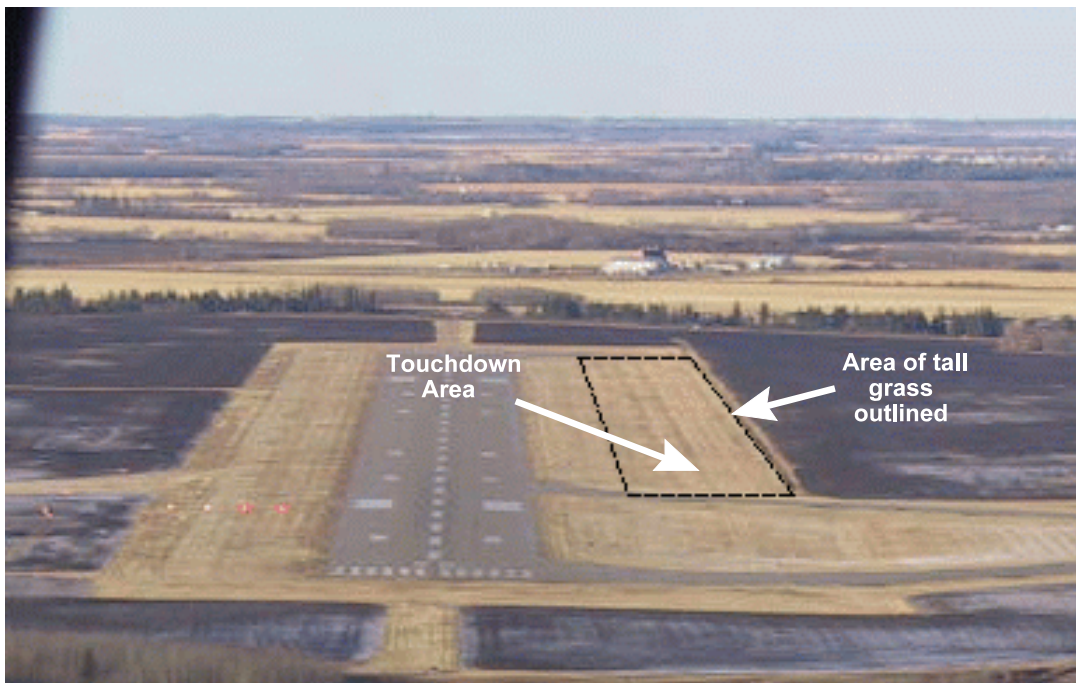


Figure 1 – Landing area, after the snow had melted

Records indicate that the aircraft was maintained and certified in accordance with existing regulations. There were no apparent mechanical malfunctions with the aircraft or with the ground based navigation aids used to conduct an instrument approach at Peace River. The aircraft's weight and balance was maintained within normal operating limitations throughout the flight.

Both pilots were qualified for the flight under existing regulations. The captain had been a captain on the DHC-8-100 for four years, and the first officer had been flying the aircraft type for about a year and a half. The pilots had flown together before and were familiar with Peace River Airport. This was the first time they had flown to the airport that season with snow on the ground.

As required by regulation, the aircraft was equipped with both a flight data recorder (FDR) and a cockpit voice recorder (CVR). Both the FDR and the CVR were serviceable and recorded information pertaining to the occurrence. Although FDR information was available to investigators, CVR information was overwritten because of the duration of the flight.

The approach lights for Runway 22 at Peace River are a low-intensity type. The lights are required by regulation to be operated for arriving aircraft during daytime IFR weather conditions, and were on. The runway threshold, end, and edge lights are a medium intensity type with three possible settings. These lights are also required by regulation to be operated for arriving aircraft during daytime IFR weather conditions. For visibility conditions of more than three miles, an intensity setting of 1 or 2 is required; the lights were on setting 2 for CDR8321's first approach and setting 3 for the second approach. Setting 3 is permitted if requested by a pilot. The PAPI lights are required to be on if the runway is in use. Both pilots saw the PAPI lights, however neither pilot could recall seeing the approach or runway lights during the first approach.

Runway 22 is not equipped with runway identification lights (RILS) or an omnidirectional approach lighting system (ODALS). RILS consist of two uni-directional flashing strobe lights at the threshold of a runway. Aerodrome Standards TP 312 recommends that RILS be installed at aerodromes where terrain precludes the installation of approach lights or where unrelated, non-aeronautical lights, or the lack of daytime contrast reduces the effects of approach lights. RILS are required to be turned on in the daytime if visibility is five miles or less. ODALS consists of seven omnidirectional, variable intensity, sequenced flashing lights, which provide circling, offset, and straight-in visual guidance for non-precision approach runways. ODALS are required to be turned on at night or in daytime IFR conditions for arriving aircraft. Because they produce a high-intensity, flashing light, they are more likely to be seen in the daytime compared to low-intensity approach lights or medium-intensity runway lights. Aerodrome Standard TP 312 indicates the intention to replace existing approach lighting systems for non-precision approach runways with ODALS before 01 January 2005.

The day before the occurrence, the grass around the perimeter of Runway 04/22 was being cut when it started to snow, and the airport maintenance worker did not finish. The grass around the runway perimeter had been cut except for a strip about 150 feet wide and about 4000 feet long beside and parallel to the runway. Runway 04/22 is asphalt surfaced and is 150 feet wide and 5000 feet long. The grass that had been cut was about five centimetres long and the uncut grass was about 15 centimetres long. At the time of the occurrence, snow had accumulated to a depth of about three centimetres. The short grass was covered with snow but the long grass protruded through the snow. The protruding grass was light brown in colour. The uncut grassy strip contained some tracks from ground vehicles. A wind sock was near the middle of the far end of the grassy strip and the PAPI lights for Runway 04 were just beside the far end.

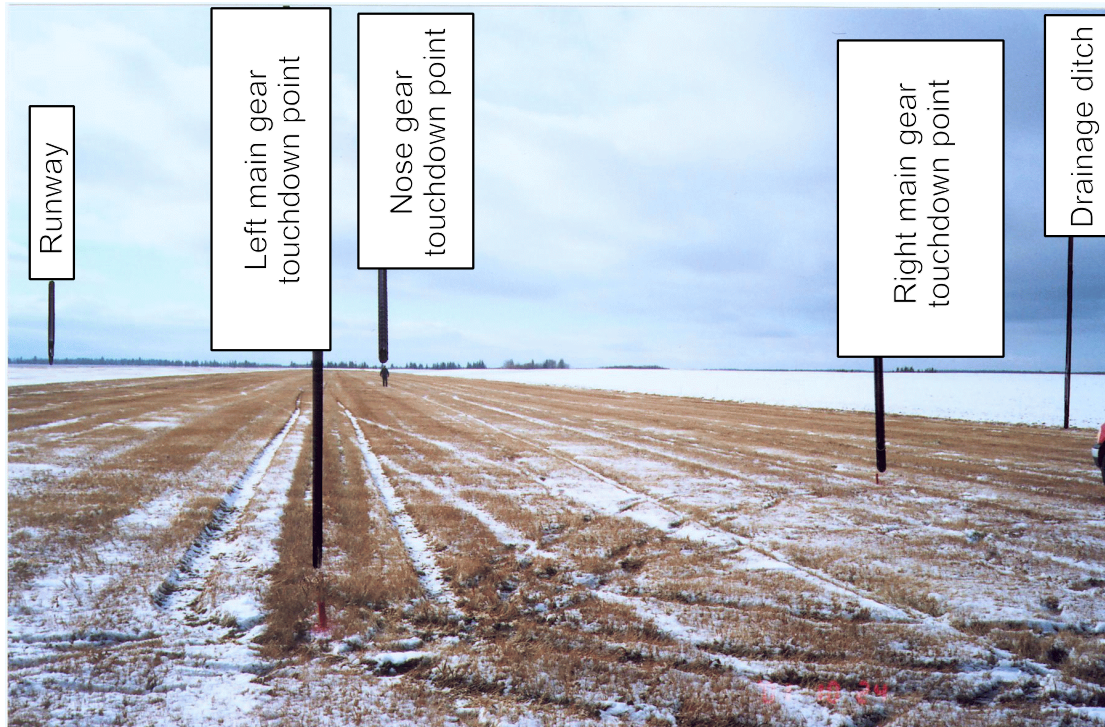


Figure 2 – Touchdown area, before the snow had melted

Pilots of aircraft on instrument approaches are prohibited from descending below decision height or minimum descent altitude specified for the approach unless a visual reference has been established and maintained in order to complete a safe landing. These visual references include at least one of the following: runway or runway markings; runway threshold or threshold markings; touchdown zone or touchdown zone markings; approach lights; approach slope indicator system; runway identification lights; threshold and runway end lights; touchdown zone light; parallel runway edge lights; or runway centre line lights. In this instance, the crew saw and maintained visual reference with the PAPI lights and what they believed to be the runway and runway threshold.

Although there is no requirement for the Peace River Airport to have a snow action plan, it appears as an appendix to its *Airport Operations Manual* (AOM). The plan indicates that, at all times, maintenance staff should not permit snow to accumulate on Runway 04/22 to a depth of more than 1.25 centimetres, and should endeavour to maintain a CRFI value of 0.3 or better. The plan also states the following:

Runways, taxiways and aprons must be cleared so that aircraft can land, taxi, and park safely. This means that the pavement is cleared of lumps of snow, chunks of ice and other foreign objects. Paved areas are to be kept to bare surface conditions to the maximum extent possible. Particular attention should be paid to those days during winter when “white out” conditions may exist. Maintenance crews are to provide a means by which a visual contrast can be provided to delineate the runway environment from the fields surrounding it. A single pass of the grader, snow plow, or sweeper should be sufficient, however if time permits more than one pass should be done.

The airport maintenance worker was concerned that, with the snow and temperature conditions that existed on Runway 22 on the morning of the occurrence, sweeping the runway might cause the small amount of slush under the snow to freeze, lowering the CRFI. He decided not to sweep because he believed that if the CFRI dropped below 0.3, CDR8312 might be required to divert to another airport. As a rule of thumb, he would not clear the runway unless snow accumulated to a depth of more than 1.25 centimetres, or unless the CRFI dropped to 0.3 or below. However, he was not aware that these were actual requirements in the AOM. He was also not aware of the requirement to provide a visual contrast between the runway environment and surrounding fields.

The maintenance worker had not received initial or recurrent training or testing concerning the AOM (including the snow action plan), nor is there a requirement for such training or testing. His only training had involved modules on how to work specific equipment.

A review of the TSB occurrence database revealed that between 1976 and 2001, there were 45 occurrences in Canada where an aircraft landed in an area mistaken for an intended runway. The two factors that contributed the most to these occurrences were a snow-covered runway and mistaking a ground feature for a runway feature. In five of the 45 occurrences, both of these factors were present. The incidence of these occurrences has been fairly uniform over time, and none of the occurrences resulted in fatalities or serious injuries.

Prior to the privatization of Canadian airports, Transport Canada (TC) provided standards and guidelines for winter maintenance at airports owned and operated by the department through a series of policy documents. As a result, there were different requirements at TC and non-TC airports. These airports still provide various levels of winter maintenance. Currently, Part III of the *Canadian Aviation Regulations* (CARs) and the current TP312, *Aerodrome Standards and Recommended Practices*, provide only limited recommendations relating to airport winter operations.

In November 2000, a TC working group was created to study existing standards, assess their suitability, and make recommendations for the development of standards for winter maintenance and planning. The working group's final report was completed in June 2001, and *Notices of Proposed Amendments* (NPA) 2001-257 and 2001-258 were developed for review at the Canadian Aviation Regulation Advisory Council (CARAC), Part III, Technical Committee, meeting held September 5th to 7th, 2001. The working group's report was accepted by the committee and the proposed NPAs were accepted with amendments. The proposed regulations and standards are proceeding through the final approval process and are scheduled to come into force before fall 2002.

On 26 November 2001, *Aerodrome Safety Circular* (ASC) 2001-011 was issued. This ASC contained NPA 2001-257 and 2001-258 as attachments, and encouraged airport operators to develop local transition procedures to facilitate conformance to the new regulations and standards in a timely manner.

The objective of airport winter maintenance planning, as identified in the NPA standard, is to minimize the effects of winter conditions and establish procedures to prevent or eliminate hazardous conditions during the airport's published hours of winter maintenance, in order to maintain safe aircraft operations. Although the standard addresses knowledge, training, and testing of airport personnel with duties related to winter maintenance, it does not address the issue of maintaining a visual contrast to delineate the runway environment from areas surrounding it.

Analysis

The flight crew's communications with the Peace River FSS specialist after the go-around indicated that the crew thought that they had landed on Runway 22 when, in fact, they had landed on a grassy area beside the runway. Their actions were consistent with an error known as perceptual confusion² which occurs when, during a highly routine task, one object is accepted as a match for the intended object because it looks like the intended object, is in the expected location, and does a similar job.

In this occurrence, the crew landed on the grassy area for the following reasons:

- the grass area looked like the intended runway. It was rectangular in shape, approximately the same length and width as the runway, and was oriented in the same direction. The crew expected to see a snow-covered runway with brown sand patches; the grass area was snow-covered with brown grass protruding above the snow. Ground vehicle tire tracks in the grassy area could have been confused with tracks from other aircraft;
- the landing area was in the expected location, where the approach plate indicated the runway would be. Although the threshold of what was believed to be the runway was further along the approach path than the actual runway—in relation to taxiways, terminal building, PAPI lights, etc.—this difference was not sufficient to alert the crew;
- Runway 22 and the associated taxiways were snow-covered and blended in with the surrounding area, also snow-covered. Runway markings were not visible and the runway could not be located by reference to the adjoining taxiways;
- cues which could have indicated that the aircraft was not landing on the runway were not compelling. The lateral displacement from Runway 22 was not sufficient to cause a noticeable deflection of the VOR needle. The PAPI lights were further to the left of the landing area than normal, but not displaced enough to be noted by the crew. The crew probably would not monitor the VOR and PAPI indications on short final. Although the approach and runway

² Reason, J. (1990) Human Error. New York: Cambridge University Press.

lights were on, the lights would have been hard to see³ because of their intensity, the time of day, and the snow-covered background; and,

- the runway was not equipped with RILS or ODALS, which would have provided more compelling cues that the aircraft was landing in the wrong place.

The airport maintenance worker did not sweep Runway 22 prior to the arrival of CDR8321 for two reasons. Firstly, he was concerned that sweeping the runway might make it more slippery. Secondly, he was not aware of the requirement to provide a visual contrast between the runway environment and surrounding fields. His lack of training concerning the contents of the AOM likely contributed to this lack of awareness. Also, the lack of a requirement for such training contributed to him not receiving it. TC's proposed standards for airport winter maintenance and planning address knowledge, training, and testing of airport personnel with duties related to winter maintenance; however, the standards do not address the issue of maintaining a visual contrast to delineate the runway environment from the fields surrounding it.

Based on historical occurrence information, the probability is low that an aircraft will land in an area mistaken for the intended runway even when the intended runway is snow-covered. The severity of consequences associated with such occurrences has also been low, indicating an overall low level of risk. Nevertheless, the risk could be reduced by increasing pilot awareness of the issue, by maintaining runway contrast, and by providing more compelling runway identification lighting.

Findings as to Causes and Contributing Factors

1. The airport maintainer did not receive training concerning the contents of the AOM, which likely contributed to him not being aware of the requirement to provide a means by which a visual contrast can be provided to delineate the runway environment from the fields surrounding it.
2. The airport maintainer was not aware of the requirement to provide a means by which a visual contrast can be provided to delineate the runway environment from the fields surrounding it, which likely contributed to him not sweeping Runway 22 prior to the arrival of CDR8321.
3. The airport maintainer was concerned that sweeping the runway would make it more slippery, which contributed to him not sweeping Runway 22 prior to the arrival of CDR8321.
4. Runway 22 was snow-covered, which contributed to the flight crew not distinguishing it from the surrounding snow-covered fields.

³ Flight tests conducted by TSB after this occurrence demonstrated that the lights were hard to see in the daytime, even when on the highest intensity setting and against a darker background.

5. A strip of uncut grass, similar in colour and size to the intended runway, protruded above the snow in an area beside the runway. The flight crew mistook the grassy area for the runway and landed on it.
6. There were no compelling cues, such as those that could have been provided by RILS or ODALS, to alert the flight crew that they were not landing on Runway 22, which contributed to them landing off the intended runway.

Findings as to risk

1. Proposed standards for airport winter maintenance and planning do not address the issue of maintaining a visual contrast to delineate runways from the surrounding terrain.
2. There is currently no requirement for non-TC airports to have standardized plans for winter maintenance.
3. There is currently no regulatory requirement for airport maintainers at non-TC airports to receive training in airport winter maintenance and planning.

Safety Action Taken

On 14 January 2002, Air Canada Regional issued a Flight Operations Bulletin to its pilots concerning this occurrence. The bulletin described how the flight crew may have been the victim of a visual illusion and suggested that better runway lighting may have prevented the incident. The Flight Operations Bulletin also introduced a new procedure. The procedure requires that Air Canada Regional pilots have runway lighting systems operational and give consideration to having the system selected to full intensity during operations in low visibility or situations that obscure the runway environment such as low drifting snow or snow-covered runways.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 23 October 2002.