INCIDENT

Aircraft Type and Registration:	DHC-8-402 Dash 8, G-JEDR
No & Type of Engines:	2 Pratt & Whitney Canada PW150A turboprop engines
Year of Manufacture:	2003
Date & Time (UTC):	30 November 2010 at 1902 hrs
Location:	Bournemouth Airport, Dorset
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 4 Passengers - 69
Injuries:	Crew - None Passengers - None
Nature of Damage:	Damage to frangible 'touch runway' switch
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	48 years
Commander's Flying Experience:	9,000 hours (of which 765 were on type) Last 90 days - 168 hours Last 28 days - 39 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and further enquiries by the AAIB

Synopsis

As the aircraft approached touchdown following a flap 0° approach, the pilot increased the pitch attitude to control the rate of descent and the aft lower fuselage of the aircraft struck the runway. One Safety Recommendation was made.

History of the flight

The aircraft was on a VOR approach to Southampton Airport in icing conditions when, as the first stage of flap was selected, the amber FLAP POWER caution illuminated on the Caution and Warning Panel (CWP) and the flaps remained up. The crew calculated that the runway at Southampton Airport was not long enough for a flap 0° approach in icing conditions and decided to carry out an ILS approach to Runway 08 at Bournemouth Airport. The weather conditions reported at Bournemouth Airport were wind from 050° at 10 kt, 10 km visibility, broken cloud at 1,500 ft aal, and a temperature of 1°C.

Seven miles from touchdown on the final approach to Bournemouth Airport, the aircraft's landing gear was down, its speed was stabilised at a V_{REF} of 150 kt IAS and its attitude was 5° nose-up. At 1,000 ft aal, the commander disconnected the autopilot and began to fly manually, in accordance with the Emergency Check List (ECL). When the aircraft was within approximately 2 nm of the runway, the co-pilot began to call out the

aircraft's pitch attitude. As the aircraft approached the touchdown point, the commander perceived a high rate of descent and increased the pitch attitude to reduce it. The co-pilot called "PITCH 8°, DON'T PITCH ANY MORE" but, as the aircraft touched down, a Master Warning was triggered and the crew observed the TOUCHED RUNWAY caption illuminate on the CWP. The aircraft vacated the runway and taxied to a parking stand, where the pilots carried out a normal shutdown. An inspection of the aft lower fuselage of the aircraft revealed that the frangible touch runway detection switch was broken.

Comments from the commander

The commander commented that, although he was aware of the ECL requirement to avoid pitch attitudes in excess of 6° at touchdown, he found the temptation to flare the aircraft to reduce the rate of descent overwhelming. He also thought that the advice in the ECL to gradually reduce power to achieve flight idle at touchdown might have contributed to the aircraft's high rate of descent. In addition, the commander reported that the wind dropped significantly as the aircraft approached the runway – an assessment confirmed later by the operator following flight data analysis – which might have caused some windshear to be present in the final stages of the approach.

AAIB investigation into a similar event

The report of an AAIB investigation into a tail strike incident involving another DHC-8-402 Dash 8[1] referred to the manufacturer's Service Letter DH8-400-SL-00-020, which advised operators to include in their procedures an alert call at 5º pitch attitude and stated that:

> *'Descent control below 200 ft agl must be through power lever management rather than adjusting pitch.'*

The manufacturer commented further that:

> *'The result of small power lever movement ahead of FLIGHT IDLE is an immediate reduction in the sink rate even before there is an actual increase in power due to the effectiveness of lift due to slipstream.'*

Operator's investigation

The operator's investigation of the incident, which included an interview of the crew and analysis of flight data downloaded from the aircraft, highlighted some anomalies in the company's manuals. The ECL for a landing with an abnormal flap configuration (flap 5° or flap 0°) instructs pilots to:

> *'Reduce power gradually to achieve FLT IDLE at touchdown.'*

In Part B4 of the operator's Operations Manual, the section that deals with landing with an abnormal flap configuration states that:

> *'Power should be reduced to FLT IDLE at touchdown and the nose-wheel promptly lowered to the ground.'*

The Airplane Flight Manual (AFM) for the aircraft considers abnormal flap landings and states:

> *'Power should be reduced gradually to achieve FLT IDLE at or just prior to touchdown.'*

In all cases, there is a caution to avoid pitch attitudes in excess of 6° at touchdown.

Footnote

[1] AAIB Bulletin 7/2010; aircraft registration G-ECOZ, which was not carrying out a flap 0° approach.

Flight data showed that the commander began reducing power to FLT IDLE when the aircraft was below approximately 30 ft agl.

Discussion with the manufacturer

The operator believed that the ECL requirement to reduce power gradually to achieve FLT IDLE at touchdown contradicted the manufacturer's advice to use power to manage the rate of descent below 200 ft agl. The manufacturer offered a further explanation to the company, which was subsequently reiterated to the AAIB:

> *'With the aircraft flying at the correct V_{REF}, the power levers are intended to be selected to FLIGHT IDLE immediately prior to the main wheels arriving on the runway surface. In the abnormal flap condition, the [difference is that] power levers are put to FLIGHT IDLE "at" ahead of "just prior to" touchdown. The pitch attitude for a flap 0 or 5 degree landing, when stabilized at the correct V_{REF}, will give a pitch attitude of between 5 and 6 degrees, which, from a pilot handling perspective, should suggest a flare is not possible and power will be maintained to main wheel contact followed by promptly lowering the nosewheel to the runway.'*

The AFM states in the section on normal landing procedures that:

> *'To decrease the landing descent rate, when the landing descent rate is higher than desired, power will be required in the landing flare through touchdown.'*

The manufacturer stated that procedures in the case of abnormal flap landings differed from those of normal landings only with respect to those procedures given in the AFM section on abnormal flap landings. Consequently:

> *'all the normal expected handling activities associated with power management for approach airspeed, descent rate and pitch attitude control are relevant [to an abnormal flap landing] and expected to be executed by the pilot flying.'*

At light weights in the flap 5° configuration, the power levers would need to be selected to FLT IDLE just prior to, rather than at, touchdown and so the AFM abnormal flap procedure covered both conditions of power management. In addition:

> *'power lever movement toward FLT IDLE should be gradual to avoid a sudden pitch attitude change.'*

The manufacturer believed that the AFM contains adequate information to enable pilots to control the rate of descent at maximum pitch attitude and concluded that, in this incident, the appropriate pilot action required the:

> *'application of power coincidental with lowering of the pitch attitude to the allowed 6°.'*

Rate of descent

An aircraft with a typical V_{REF} of 120 kt in a 10 kt headwind would require a rate of descent of 582 ft/min to maintain a 3° glidepath. During the incident approach, flight data showed that the groundspeed of the aircraft between 1,000 ft and 20 ft agl varied between 131 and 139 kt, with a typical value of 136 kt. This groundspeed required a rate of descent of 720 ft/min to maintain a 3° glidepath, representing a 24% increase

from a typical approach. The operator required its pilots to practise a flap 0° approach in the simulator once every three years.

As G-JEDR descended between 300 and 100 ft agl, its rate of descent was between 700 and 800 ft/min. The rate of descent increased to 1,000 ft/min as the aircraft descended to 30 ft agl and then reduced progressively to 200 ft/min at touchdown. The reduction in rate of descent corresponded to an increase in aircraft pitch attitude from 6° nose-up at 30 ft agl to 9° nose-up immediately before touchdown. The power levers were retarded slightly as the aircraft passed 100 ft agl and retarded to idle below 30 ft agl.

Analysis

The rate of descent required for a flap 0° approach is significantly higher than for a normal approach but the operator's pilots practise flap 0° approaches in the simulator only once every three years. Consequently, the incident aircraft pilot's perception of a high rate of descent might be expected of most of the operator's pilots when flying a flap 0° approach. The aircraft's rate of descent was already higher than required when the pilot began to reduce power towards FLT IDLE in accordance with the ECL instructions. The reduction in power would probably have increased the rate of descent further in the absence of any other action. However, the pilot increased the aircraft pitch attitude at the same time, and the aft lower fuselage struck the runway.

The manufacturer considered that sufficient information was provided in the AFM to enable crews to control high rates of descent during abnormal flap landings. A note in the AFM section regarding normal landings indicated that power may remain applied until touchdown to reduce the rate of descent and the manufacturer stated that this technique is also applicable to the abnormal flap landing case. The manufacturer also commented that, in abnormal flap landings, the pitch attitude is so close to the pitch limit that a flare is not possible and power will be maintained until main wheel contact.

With regard to landing with abnormal flap, the current edition of the ECL instructs pilots to reduce thrust gradually to achieve FLT IDLE '*at*' touchdown, meaning that power reduction will begin while the aircraft is still airborne. In this respect, the ECL instructions describe power lever control in a flap 5° landing at light aircraft weight. However, as a source of guidance for pilots who rarely fly or train for abnormal flap approaches, the ECL should contain the most complete information that it is practical to provide. Therefore, the following Safety Recommendation is made:

Safety Recommendation 2011-081

It is recommended that Bombardier Aerospace amends the DHC-8-402 Dash 8 emergency checklist section concerning abnormal flap landings to reflect their advice that power will be maintained until main wheel contact.