ACCIDENT

Aircraft Type and Registration:	DHC-8-402 Dash 8, G-JECX
No & Type of Engines:	2 Pratt & Whitney Canada PW150A turboprop engines
Year of Manufacture:	2007 (Serial no: 4155)
Date & Time (UTC):	17 April 2018 at 1205 hrs
Location:	Newquay Airport, Cornwall
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 4 Passengers - 55
Injuries:	Crew - 1 (Minor) Passengers - None
Nature of Damage:	Damage to several skin panels, frames and stringers and the aft pressure bulkhead
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	46 years
Commander's Flying Experience:	7,200 hours (of which 1,065 were on type) Last 90 days - 70 hours Last 28 days - 26 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and further enquires by the AAIB

Synopsis

The crew were operating their third sector of a four-sector day from Manchester to Newquay. Weather at Newquay included low cloud, light rain and a moderate wind. On the second approach to Runway 12 the aircraft developed a high sink rate below 50 ft. The pilot flying reacted to the sink by increasing the pitch attitude, which resulted in the aircraft tail striking the runway before the main landing gear.

History of the flight

The flight crew reported at Manchester Airport for a departure at 0610 hrs flight to Amsterdam Schipol Airport. They were rostered to operate four sectors in G-JECX: to Amsterdam, back to Manchester, to Newquay Airport and finally return to Manchester. The first two sectors to Amsterdam were uneventful but the return flight was delayed by one hour and ten minutes due to a problem with the load sheet. The third sector from Manchester to Newquay departed one hour and twenty minutes late. The forecast weather at Newquay was for overcast cloud at 400 - 500 ft with a gusty crosswind of approximately 20 kt. The co-pilot was pilot flying for the Newquay sector.

The takeoff, cruise and descent were uneventful. During the cruise the commander obtained updated weather via the ATIS for Newquay, which gave landing Runway 12, the surface wind 210/16 and cloud broken at 400 ft. The flight crew briefed for the approach,

discussing the threat of turbulence on final and the potential for a go-around. The pilots planned to use flap 15 for the final approach because no gusts were reported on the ATIS, and to set the propeller condition levers to MAX in case a go-around was required[1].

The aircraft was established on final for Runway 12 at 8 nm and the co-pilot disconnected the autopilot at approximately 500 ft. At approximately 400 ft, the aircraft became displaced from the runway centreline and the co-pilot elected to go around. The go-around was uneventful and the aircraft was repositioned for a second approach. During the downwind leg the commander made a PA to reassure the passengers then briefed the co-pilot to keep the autopilot engaged until slightly later in the approach and to ensure the speed remained between the V_{REF} and V_{CLIMB} speed bugs[2].

The second approach was stable until approximately 50 ft. The tower gave the surface wind as 190º/20 kt. At approximately 50 ft the co-pilot reduced power to flight idle to control the airspeed, although neither pilot was aware that the power had been reduced this much. At approximately 30 ft above the runway, the aircraft started to sink rapidly and the commander called "power, power, power". The co-pilot increased power and pitched up to arrest the rate of descent, but the aircraft landed firmly, striking its tail on the runway. The aircraft bounced and the commander took control. Observing the 'TOUCHED RUNWAY' light he elected to continue the landing. The aircraft landed and taxied to the gate without further incident.

Subsequently one cabin crew member reported minor back pain. No other injuries were reported.

Recorded information

The FDR and CVR contained recordings of the event. The pertinent data from the FDR is shown in Figure 1.

At approximately 100 ft, engine torque reduced corresponding to an increase in airspeed. Torque increased at approximately 80 ft as the airspeed started to reduce. Torque reduced at approximately 40 ft to idle and the airspeed reduced further. The data suggests that this corresponded with a reduction in headwind, although the sample rate is too low to determine this exactly. At approximately 20 ft power increased markedly and pitch attitude increased.

The aircraft tail touched the runway at 2.1g with the aircraft at a pitch attitude of 10º nose up. The main wheels touched down 4.8 seconds after the tail touched.

Footnote

[1] Propeller rpm is normally set to 850 rpm to reduce noise but can be set to 1,020 rpm (MAX) to give quicker engine response.

[2] V_{CLIMB} is the minimum safe single engine climb speed.

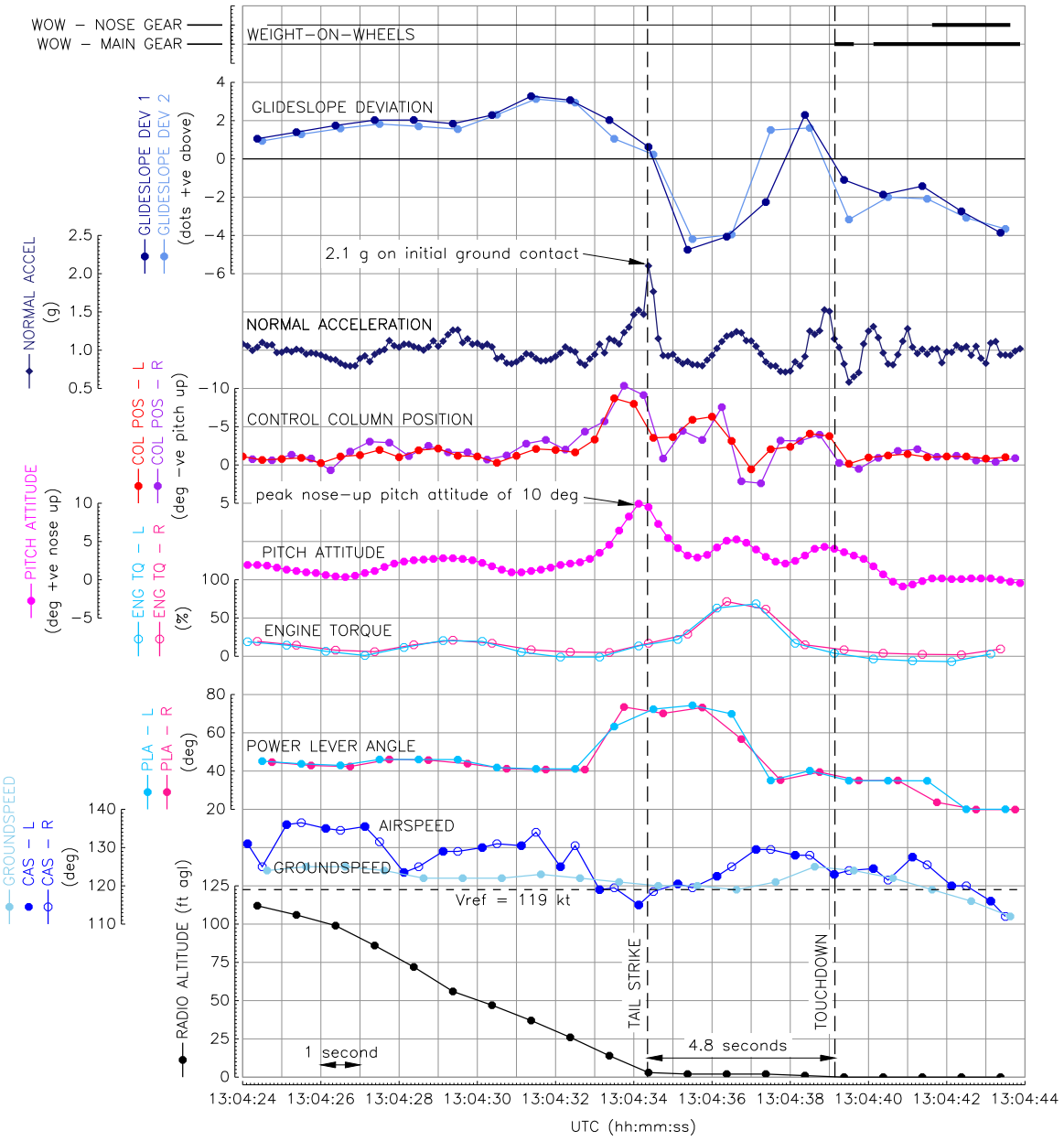

Figure 1

Selected information from FDR

Aircraft information

The engines of the DHC-8-402 are mounted on the wing. In this configuration, airflow over the wing behind the propellers will affect the total lift produced. Consequently, a decrease in selected torque, producing less airflow behind the propellers, will decrease lift, even if the airspeed remains the same.

The operator uses two landing flap settings: Flap 15 or Flap 35. Its operations manual states that the preferred landing flap is Flap 15, and it requires Flap 35 to be used if the landing distance available is less than 1,800 m.

The aircraft crosswind landing limit is 32 kt. Co-pilots, having completed their first recurrent simulator check and demonstrated competence in crosswind landing, can operate to this limit.

The normal pitch attitude for a Flap 15 approach is approximately 3º with an engine torque of 13-15%. During the landing flare the pitch attitude should be increased by 1-2º. The operator requires the pilot monitoring to make a warning call of "PITCH FIVE" if the pitch attitude reaches 5º during the flare. Its operations manual states:

> *'A pitch attitude greater than 6º on touchdown can lead to a tail strike. If the pitch attitude reaches 6º nose-up or if a non-normal sink rate develops on short finals, the pilot flying (PF) is required to respond with "correcting" and shall correct with an increase in power with no further increase in pitch attitude. An increase in power provides an immediate increase in lift to arrest the descent.'*

Following several tailstrike events the aircraft manufacturer issued a Flight Operations Service Letter DH8-400-SL-00-020, dated 11 September 2008, to remind operators of the importance of pitch attitude awareness during the flare. The letter states *'Descent rate control, below 200 ft agl, must be through power lever management rather than adjusting pitch'.* The letter recommends that operators should provide initial and annual recurrent pitch awareness training for flight crew.

Aircraft examination

The aircraft was examined by the manufacturer. Damage was found to several skin panels, frames, stringers and aft pressure bulkhead.

Figure 2
Damage to aft fuselage

Weight and balance

The aircraft landing weight was approximately 25,000 kg, 3 tonnes below the maximum landing weight of 28,009 kg. Its centre of gravity was within limits.

Aircraft performance

The required landing distance in the prevailing conditions was 1,173 m.

Meteorology

During the descent the flight crew obtained the latest airfield weather, which reported: landing Runway 12, surface wind 210/16, visibility 3,500 m in light rain, cloud broken at 400 ft and temperature 12°C.

Airfield information

Newquay's Runway 12 has a landing distance available of 2,637 m. The commercially available airport chart used by the pilots contained a warning note:

> *'Possibility of terrain induced turbulence and wind shear effects when landing on Runways 12 & 30.'*

Organisational information

The operator's operations manual defines the criteria to achieve a stable approach. If these criteria are not met and maintained a go-around must be flown. The operator's criteria are divided into two distinct gates; an "Approach Gate" at 1,000 ft ARTE[3] and a "Landing Gate" at 500 ft RA[4].

At the Approach Gate, the aircraft must be on the correct vertical and lateral profile with airspeed 150 kt or less, landing gear down and Flap 15 or greater.

At the Landing Gate, the aircraft must be on the correct vertical and lateral profile with only small changes in heading, pitch and speed required to maintain the correct flight path. The power must be appropriate to the configuration, airspeed less than V_{REF}+15 kt and vertical speed no greater than 1,000 fpm. The landing checks must be complete.

Previous similar events

A similar event occurred at Newcastle Airport in January 2017, reported in AAIB Bulletin 10/2017[5].

In October 2016, the Australian Transport Safety Board published a study into two similar events[6].

Footnote

[3] Above Runway Threshold Elevation.
[4] Radio Altitude.
[5] https://www.gov.uk/aaib-reports/aaib-investigation-to-dhc-8-402-g-ecoj (accessed September 2018).
[6] https://www.atsb.gov.au/media/5771758/ao-2013-201-final-report.pdf (accessed September 2018).

Analysis

During the first approach the aircraft became displaced from the centreline in the turbulent conditions. The co-pilot decided to go around as he was concerned the approach no longer met the operator's stable approach criteria.

The second approach met the stable approach criteria until approximately 50 ft. At this point the co-pilot reduced power to flight idle in response to increase airspeed, although neither pilot was aware that the power had been reduced this much. The reduction in power, probably combined with a reduction in headwind, resulted in a significantly increased rate of descent. The co-pilot reacted instinctively by increasing power and pitch attitude. The pitch attitude increased to 10º, which resulted in the aircraft tail contacting the runway before the main wheels. The increase in power did not take effect before the tail contacted the runway. The commander reacted to the increased rate of descent by calling for more power in accordance with the operator's and manufacturer's guidance. The time from pitch attitude increasing beyond 5º to the tail contacting the runway was less than one second, giving very little time for the commander to take any corrective action. After the tail strike the commander took control and elected to continue the landing as he was concerned the aircraft may be damaged.

Conclusion

The tailstrike occurred because the pilot flying reacted instinctively to the high sink rate by increasing pitch attitude and power, rather than increasing power only. The aircraft manufacturer recommends that operators provide annual recurrent training in pitch awareness for flight crew to establish the correct response to high sink rate near the ground.