SERIOUS INCIDENT

Aircraft Type and Registration:	Dornier 328-100, DO328, G-BWWT
No & Type of Engines:	2 Pratt & Whitney Canada PW119B turboprop engines
Year of Manufacture:	1995 (Serial No: 3022)
Date & Time (UTC):	22 March 2012 at 0955 hrs
Location:	Norwich International Airport
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 3 Passengers - 24
Injuries:	Crew - None Passengers - None
Nature of Damage:	Runway edge light broken
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	59 years
Commander's Flying Experience:	20,175 hours (of which 2,800 were on type) Last 90 days - 24 hours Last 28 days - 14 hours
Information Source:	AAIB Field Investigation

Synopsis

The pilot became visual with the runway at about 1 nm, with the aircraft about ½ nm south of the centreline after levelling at MDA from an NDB/DME approach to Runway 09 at Norwich. The aircraft subsequently touched down tracking towards the right edge of the runway. The aircraft's right main landing gear went onto the grass and broke a runway edge light but the subsequent go-around and landing were uneventful.

History of the flight

G-BWWT was on a scheduled flight from Manchester International Airport to Norwich International Airport and the sector was uneventful until the final part of the approach. Before descent the crew received the ATIS that stated the visibility was 4 km in haze and the wind was from 110° at 07 kt. The commander, who was pilot flying (PF), subsequently briefed for radar vectors to the final approach for an NDB/DME approach to Runway 09. The co-pilot, who had gained his captaincy seven months before the incident, was the pilot monitoring (PM). Figure 1 shows the NDB/DME approach plate to Runway 09, with flight path overlay.

The aircraft descended to 2,000 ft amsl heading 120°M and established on the inbound bearing of 088°. At this point the aircraft was configured for landing and the landing checks had been completed. The aircraft then intercepted the nominal 3° descent path at 5.8 nm using the autopilot's (A/P) vertical speed mode. During the later part of the approach, while still above MDA, the

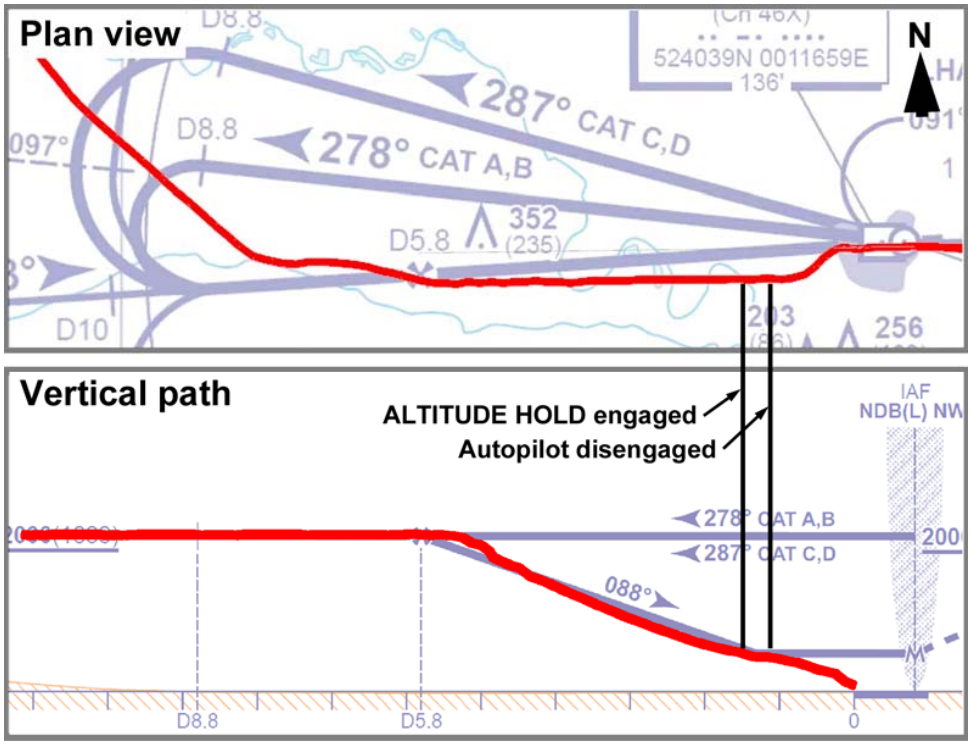

Figure 1

Excerpt from NDB/DME approach plate, Runway 09 at Norwich, with flight path overlay

commander could see the ground and was aware of his position due to his local area knowledge.

At the MDA of 580 ft amsl[1] the commander levelled the aircraft by selecting ALT HOLD on the A/P's mode control panel. "A few seconds later" he became visual with the runway and was, by his estimation, about ¾ nm south of the centreline. The co-pilot could not see the runway as it was obscured by the aircraft's structure. The commander, believing he could land off the approach, disconnected the autopilot and manoeuvred the aircraft to line up with the runway centreline. The aircraft crossed the runway threshold with right bank applied, tracking towards the right-hand edge of the runway and touched down, firmly. As the aircraft touched down, or possibly just before, the co-pilot called "go-around"; this was flown by the commander without event.

ATC subsequently offered the crew an approach to either Runway 09 or Runway 27. Due to the light wind they elected to fly an ILS approach to Runway 27; the subsequent approach and landing was uneventful. After landing the crew noticed a broken runway edge light near to the Runway 09 threshold and assumed their aircraft had broken it after their first approach; they reported this to ATC.

The commander informed the operator of the incident by telephone soon after the aircraft came onto stand and subsequently filed a MOR. The incident was reported to the AAIB the following day; as a result of the aircraft having flown after this incident the CVR had been overwritten.

Subsequent engineering inspection found no damage to the aircraft.

Footnote

[1] 560 ft amsl published minima +20 ft for a continuous decent final approach.

Airfield inspection

The airfield was inspected by the airport operator and the AAIB. Tyre marks from G-BWWT were found on the runway and grass, with a broken lens from a runway edge light. Tyre tracks from the right landing gear wheels are shown at Figure 2.

Crew's comments

Commander

The commander later commented that the forward visibility during the approach was reduced as a result of flying towards the sun. He added that it was poor judgement on his part to fly the unstable manoeuvre after he became visual with the runway.

At 1000 hrs on 22 March 2012, the sun's elevation was 32.3° and its bearing was 143.2°T.

Co-pilot

The co-pilot stated that this was his first time in the right seat since gaining his captaincy and it was decided between the flight crew that the commander would be PF as the co-pilot "wanted to get used to the different perspective from the right seat again."

The co-pilot added that he had been "slightly concerned" during the manoeuvre but had confidence in the commander's ability and so did not interject. He had not called 'go-around' before the aircraft was over the runway, despite it being unstable, as he thought the commander was going to line up with the centreline and land safely.

Figure 2

Photograph of runway excursion by right main landing gear

Recorded data

Flight recorders

The aircraft was fitted with an FDR and a CVR but the CVR evidence was over-written before the AAIB had been notified of the incident. The FDR recording captured the event flight, including the first approach, shown in Figure 3.

The recordings showed that the A/P was engaged with a lateral mode of HEADING SELECT for the whole approach. The A/P pitch mode transitioned from ALT HOLD to VERTICAL SPEED for the descent but at approximately 460 ft aal switched back to ALT HOLD. After a further 10 seconds the autopilot was disengaged and control inputs to correct the aircraft's position were initiated. This is considered to be the point at which the crew became visual with the runway.

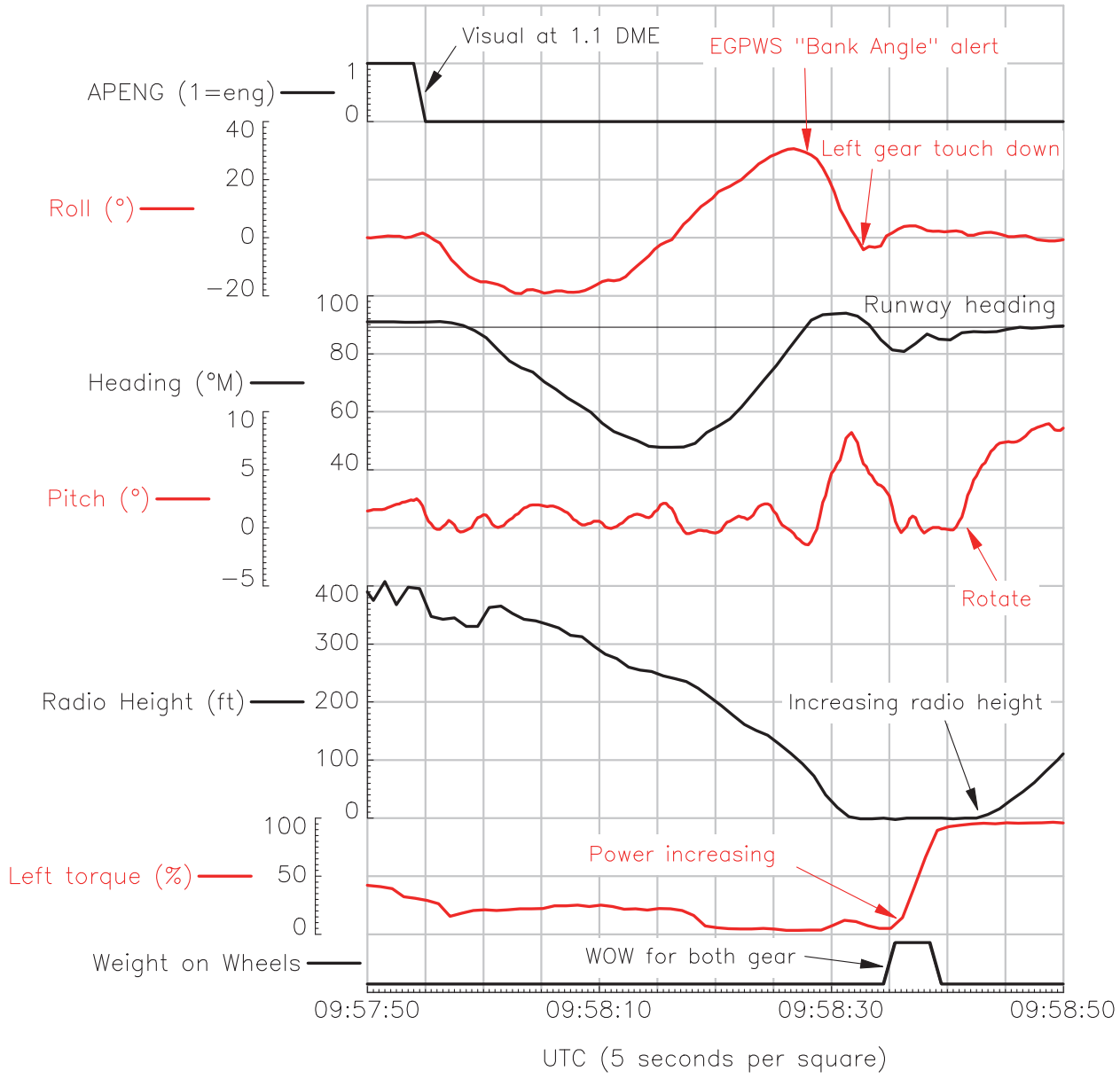

Figure 3

FDR plot of final approach

The aircraft then banked left 19°, at about 330 ft aal, followed by a right bank of 30°, at about 110 ft aal, which was transitioning to a left bank at the point of touchdown. The data indicated that the left gear touched down first with the aircraft on a heading of 093°M, to the right of the runway heading but turning towards it. Approximately two seconds later the right gear touched down and the heading was 081°M, to the left of the runway heading with the engine torque values starting to increase. Four seconds later the 'weight-on-wheels' parameter and pitch attitude indicated liftoff and the radio altimeter showed positive height after a further four seconds.

Radar and RT

NATS Radar data provided good positional information of the event approach, down to the runway elevation. This showed that the final approach descent started in the vicinity of the final approach fix location for the NDB approach procedure. The vertical profile of the descent approximately matched that of the procedure. However, the aircraft track paralleled the runway centreline (with an offset of approximately 0.4 nm until about 1.1 nm from the threshold) rather than converging with it.

Norwich radar and ATC recordings are reflected in the history of the flight.

EGPWS

An EGPWS was fitted which recorded a 'bank angle' audio alert that was not captured on any other available recording. The EGPWS also recorded one-second samples of key parameters for 20 seconds prior to the alert and 10 seconds after.

The 'bank angle' alert occurred as the aircraft radio height reduced from 84 ft to 53 ft and right roll angle reduced from 28° to 25.3°, one second after a peak of 29.5° of right roll.

Operator's Operation's Manual – stabilised approaches

Part B of the operators Operations Manual (OM) states:

> *'2.7 Actions in the event of flight path deviations*
>
> *2.7.1.7 The time of greatest risk is on landing because of the nature of the rapidly changing situation. Either pilot should, therefore, not hesitate to call for a go-around at any stage of an approach. It is clearly preferable to do a go-around than to have a serious incident or worse on landing.*
>
> *2.15.2 STABILISED APPROACH*
>
> *(e) …. stabilised approach will also permit easier assessment of crosswind, reducing the likelihood of lateral deviations which might require excessive bank angles at low altitude to correct, and in turn making a non-deviating touchdown on the runway centreline more likely.*
>
> *(h) A non-precision approach which requires an intermediate level-off, is, by definition, not stabilised. All non-precision approaches should, therefore, be flown using the CDFA [continuous descent final approach] techniques described at 2.16.2 [see below].*
>
> *(i) To summarise: an approach is stabilised when the aircraft is on the correct flightpath in the landing configuration requiring only small adjustments to maintain it, speed is within 10 kts of normal approach speed, power as appropriate and not less than 10% TQ and all briefings and checklists complete. A visual approach should be wings level by 500 ft, and a circling approach wings level by 300 ft.*

2.15.3 VISUAL CALL FOR PRECISION INSTRUMENT APPROACHES

If the required visual reference is not obtained by either pilot, HP [the handling pilot, PF] may continue the approach to DA, when an immediate go-around must be initiated.... When, at or before DA, the HP has the required references and decides to land, he will call 'VISUAL – LANDING'.

2.16 Instrument Approaches - Non Precision

2.16.1.1 The decision to Land or Go Around, at MDA, will be made by the HP. Calls and responses should be as for CAT 1 precision approaches, [see 2.15.3 above]

2.16.2 CONTINUOUS DESCENT FINAL APPROACH – CDFA

2.16.2.1 GENERAL PROCEDURES

All non-precision approaches are to be flown using CDFA techniques. This, basically, involves a continuous descent, stabilised approach from the final approach fix to either go-around at the DA or land.

2.16.2.4 A Stabilised Approach will never have any level segment of flight at DA(H) (or MDA(H) as applicable). This enhances safety by mandating a prompt go-around manoeuvre at DA(H) (or MDA(H)).

2.16.2.6 Non-Precision Approach With DME

Upon reaching the DA (published MDA + 20ft), the decision is made to land or go-around.'

Operator's Operation's Manual – preservation of recorded data

Part A of the OM states:

*'Following an **accident** [AAIB bold], the Company will, to the extent possible, preserve the original recorded data from the FDR and CVR pertaining to that accident...'*

There was no published procedure, for crews to follow after a serious incident, including the location of the appropriate circuit breakers to pull, to ensure that the FDR and CVR data were preserved.

CAA Safety Notice - preservation of recorded data

CAA Safety Notice SN-2011/011, '*Prevention Of The Loss Of Recordings From Cockpit Voice And Flight Data Recorders'* was issued on 17 August 2011 to all Air Operator Certificate (AOC) holders. It stated:

'4 Action to be Taken

4.1 AOC operators and CAMOs should ensure that robust procedures are prescribed in the relevant Operations Manuals and Continuing Airworthiness Maintenance Expositions to ensure that CVR/FDR recordings that may assist in the investigation of an accident or incident are appropriately preserved and are available for production and use. They should also ensure that, where relevant, documents which present the information necessary to retrieve and convert the stored data into engineering units are kept. In this context, an incident is an occurrence subject to mandatory reporting, i.e. a Mandatory Occurrence Report. After confirming that such robust procedures either already exist within AOC operators' Operations Manuals or that

amendments to said Operations Manuals have been proposed, operators should advise their assigned Flight Operations Inspector (FOI) of this information and CAMOs should advise the relevant CAA Regional Office.

4.2 Action should also be taken to raise awareness of flight crew and maintenance staff of such procedures.'

The operator commented that they were aware of this notice and that its OM could provide better guidance to crews in the event of a serious incident to ensure recordings are preserved.

Analysis

At the time of the incident the operator's OM stated:

'All non-precision approaches should, therefore, be flown using the CDFA techniques described.

Upon reaching the DA (published MDA + 20ft), the decision is made to land or go-around.

If the required visual reference is not obtained by either pilot, HP [handling pilot, PF] may continue the approach to DA, when an immediate go-around must be initiated.'

The commander however, selected ALT HOLD at the MDA, contrary to the standard operating procedures

The co-pilot believed that the commander was visual with the runway when he selected ALT HOLD, despite the commander not using the standard call of "VISUAL-LANDING". The co-pilot could not see the runway when the commander disconnected the autopilot and assumed that the commander was using ALT HOLD to adjust the approach path. However, given that the commander's call was non-standard, the co-pilot should have confirmed with the commander that he was visual with the runway.

The OM stated:

'A visual approach should be wings level by 500 ft, and a circling approach wings level by 300 ft.'

In this case the aircraft had 30° of right bank when it was at about 100 ft aal and its approach was unstable. A 'go-around' should have been called by the co-pilot by this point but he believed the commander would be able to land on the runway safely during the major part of the unstable manoeuvre after the autopilot was disconnected, despite the amount of bank being used at low altitude.

Safety actions

The operator later stated that they would be reviewing their standard operating procedures to reduce the risk of a repeat of this incident. Particular attention would be given to the sections of the Operations Manual, and other documents, on stable approaches, the retention of recordings after an incident and the need to notify the AAIB in a timely manner. They would also consider fitting flight data monitoring to their aircraft.

Conclusion

In this incident, the commander, who was the PF, was not visual with the runway at MDA and, in accordance with the company operating manual, should have initiated a go-around. Instead he levelled the aircraft in the hope of gaining visual references with the runway. When he did gain this visual reference the aircraft was not in a position to land without applying significant angles of bank at low level. This resulted in the aircraft touching down and tracking off the runway, with the right landing gear leaving the paved surface.