
Loss of altitude while maneuvering on approach, Boeing 727-2H3, C-GYFA

Micro-summary: This Boeing 727-2H3 lost significant altitude while maneuvering in turbulent weather.

Event Date: 2002-05-20 at 2224 UTC

Investigative Body: Aircraft Accident Investigation Board (AAIB), United Kingdom

Investigative Body's Web Site: <http://www.aaib.dft.gov/uk/>

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Boeing 727-2H3, C-GYFA

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Ref: EW/C2002/05/09

Category: 1.1

INCIDENT

Aircraft Type and Registration:	Boeing 727-2H3, C-GYFA	
No & Type of Engines:	3 Pratt & Whitney JT8D turbofan engines	
Year of Manufacture:	1976	
Date & Time (UTC):	20 May 2002 at 2224 hrs	
Location:	On approach to East Midlands Airport	
Type of Flight:	Public Transport (Cargo)	
Persons on Board:	Crew - 3	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	None	
Commander's Licence:	Airline Transport Pilot's Licence	
Commander's Age:	35 years	
Commander's Flying Experience:	8,000 hours (of which 2,080 were on type)	
	Last 90 days - 75 hours	
	Last 28 days - 23 hours	
Information Source:	AAIB Field Investigation	

Synopsis

Whilst turning to intercept the ILS localiser in turbulent weather conditions, the aircraft was given instructions to both descend and decelerate so the handling pilot extended the speedbrakes. The turbulence and later deployment of Flap 2 during the turn, whilst the speedbrakes were extended, resulted in activation of the aircraft's stick shaker stall warning device. In an attempt to recover, engine thrust was increased above go-around power but the aircraft pitched down and continued to descend. The descent was arrested after a warning from the flight engineer and resulted in the speedbrakes being retracted. The aircraft was then climbed and given further vectors to re-establish on the ILS for an uneventful landing. At its lowest point, the aircraft had descended to 1,100 feet QNH (800 feet above airfield level) and a Ground Proximity Warning had been triggered during the descent.

History of flight

The aircraft departed Copenhagen at 2044 hrs for a scheduled flight to East Midlands Airport. The crew comprised a commander and co-pilot, with the flight engineer's role being fulfilled by a second officer (a pilot). The commander was the handling pilot for the sector.

The flight went without incident until approaching East Midlands Airport, the aircraft was subjected to heavy rain and continuous light to moderate turbulence arising from local thunderstorm activity. The crew requested, and were given, radar vectors by ATC to remain clear of the storm cells showing on the aircraft's weather radar. This took them to the north-west of the airport and once clear of the weather they informed ATC they could accept an approach. At this point the aircraft was level at 3,000 feet QNH with an indicated airspeed of 225 kt. The aircraft's weight at the time was 117,000 lb, which was well below the maximum landing weight of 154,000 lb.

ATC gave the aircraft an intercept heading to establish on the localiser, with the aircraft's GPS (Global Positioning System) then indicating a distance to the localiser intercept of about 1.5 nm. From this heading the aircraft needed to turn through approximately 120° to establish on the ILS centreline. The crew were also instructed to descend to 2,000 feet QNH and reduce airspeed to 180 kt.

The commander extended the speedbrake and began a descending, 30° banked turn towards the localiser. During this turn the stick shaker activated. The crew were uncertain whether Flap 2 was also extended at this point or whether it was extended in response to the stick shake, however the aircraft continued to descend with both speedbrake and Flap 2 deployed despite the commander applying go-around thrust. The aircraft increasingly pitched down, at one point reaching 7° nose down. The co-pilot called out an altitude warning, which the commander acknowledged whilst applying considerable backforce on the controls. The aircraft had, by then, flown through the localiser and was continuing to descend. In a further attempt to arrest the descent the commander increased the power beyond the go-around thrust already set.

The use of speedbrake with the flaps extended is prohibited on the Boeing 727 and a warning horn sounds if the speedbrake lever is out of its detent when the flaps are not fully up. On initially selecting Flaps 2, the warning horn had sounded on the flight deck. The second officer occupying the flight engineer's position called out a warning but neither the commander nor the co-pilot heard her. The second officer then repeated the warning and this time it was heard by the two other pilots. The speedbrake was quickly stowed and the aircraft began a rapid climb with the pitch increasing to 19° nose-up.

At its lowest point the aircraft had descended to 1,100 feet QNH (800 feet aal) which triggered a GPWS alert, and had accelerated in the descent to 235 kt. It then climbed back to 3,000 feet and accelerated to 250 kt before the crew was able to correct the pitch and reduce the power. ATC noticed that the aircraft had flown through the localiser and provided a new intercept heading from which the crew managed to establish on the approach. The aircraft was then re-configured and landed from an ILS approach without any further incident.

Analysis

The aircraft manufacturer's Flight Crew Training Manual states:

'Speedbrakes have an appreciable effect on stick shaker speeds and initial buffets, but a lesser effect on actual stall speed. Angle of attack is higher at the same airspeed with speedbrakes up. Initial buffet speed is raised.'

'Speedbrakes, when used with flaps down, shift the position of the wing wash relative to the tail such that deep stalls could be encountered with excessive use of up-elevator. DO NOT USE SPEEDBRAKES WITH FLAPS DOWN.'

Similarly the operator's Operations Manual states:

'Do not use speedbrakes in flight with wing flaps extended'

'Do not use speedbrakes below 200 kts IAS. (To avoid nuisance stick shaker)'

Examination of data from the aircraft's flight data recorder showed that the aircraft was subjected to a normal load factor oscillating from 0.75 g to 1.36 g due to the turbulent atmospheric conditions. Under a normal load factor of 1 g with the speedbrakes extended, the stick shaker should activate (at C-GYFA's weight) at approximately 153 kt, with either Flaps UP or Flaps 2. In both configurations the margin between stick shaker activation and the stall is approximately 18 kt.

In trying to establish on the localiser the aircraft performed a decelerating turn with the speedbrake extended, which reduced its margin to stick shake. During this turn and at a speed of 180 kt it appears that the aircraft encountered a gust, changing the angle of attack sufficiently to activate the stick shaker.

Stall recovery procedure

The aircraft manufacturer's Flight Crew Training Manual gives the following procedure for stall recovery close to the ground. At the first indication of stick shaker the thrust levers should be advanced to give go-around thrust and the pitch should be adjusted to avoid terrain. The wings should then be levelled and any descent stopped, adjusting the pitch as required as the aircraft accelerates to its manoeuvring speed. The manual states that although less altitude is lost with the flaps down, if the flaps are UP then the stall recovery is usually accomplished before the flaps can be extended. During recovery, therefore, the flap position should not be changed. Pitch control may also be affected with the flaps extended as the aircraft will experience a large nose-down pitching moment at high angles of attack. This is due to airflow separation occurring initially on the inboard section of the highly swept wing, shifting the centre of lift outboard and aft.

Comment

The crew were faced with the stick shaker activating, the speedbrake warning horn and a GPWS warning all sounding, and the aircraft failing to respond to the commander's attempts to arrest its descent. Subjected to these distractions, the second officer's shouted warning about the speedbrake went unnoticed, although once repeated it was heard and acted upon immediately.

The flight deck workload had been high whilst trying to avoid the thunderstorms during the latter stages of their approach. Crew statements indicated that they felt they were too close to the localiser when ATC gave them the initial intercept heading, and that this left them having to make a big heading change close to the Final Approach Fix. This was compounded by the concurrent ATC instructions to descend and decelerate. It would have been a natural reaction to wish to use the speed brake during the descending, decelerating turn, in an attempt to comply with the instructions and establish on the approach. With the aircraft at 225 kt this would not have given them long however, before they were below the company's 200 kt speedbrake limit and approaching the minimum clean manoeuvring speed of 190 kt. With the workload still high, there was always the inherent danger of overlooking the fact that the speed brakes remained extended.