**INCIDENT**

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| **Aircraft Type and Registration:** | ATR 72-212 A, G-COBO |
| **No & Type of Engines:** | 2 Pratt & Whitney Canada PW127M turboprop engines |
| **Year of Manufacture:** | 2009 (Serial no: 852) |
| **Date & Time (UTC):** | 20 October 2013 at 0625 hrs |
| **Location:** | En route from Guernsey Airport to Gatwick Airport |
| **Type of Flight:** | Commercial Air Transport (Passenger) |
| **Persons on Board:** | Crew - 4 Passengers - 59 |
| **Injuries:** | Crew - 2 (Minor) Passengers - None |
| **Nature of Damage:** | Superficial damage to cabin furnishings. |
| **Commander's Licence:** | Airline Transport Pilot's Licence |
| **Commander's Age:** | 51 years |
| **Commander's Flying Experience:** | 10,300 hours (of which 4,524 were on type)<br>Last 90 days - 158 hours<br>Last 28 days - 78 hours |
| **Information Source:** | Aircraft Accident Report Form submitted by the pilot and enquiries by the AAIB |

**Synopsis**

A sudden, short-lived bout of severe turbulence was experienced in the vicinity of cumulonimbus (CB) cloud at FL120. The autopilot disengaged, an oil pressure warning light illuminated briefly and the aircraft climbed almost 800 ft before being flown back to FL120. Both cabin crew members suffered minor injuries but the flight was able to continue to its destination. There was superficial damage to the cabin furnishings.

**History of the flight**

The crew of four, two pilots and two cabin crew, began their duty at 0500 hrs at Guernsey Airport. They were rostered to perform two return passenger flights to London Gatwick Airport. Meteorological data indicated the presence of showery troughs moving northeast along the English Channel. Scattered showers and localised thunderstorms were forecast and there were warnings of localised severe turbulence and windshear associated with CB clouds. The commander, who was PNF, briefed the cabin crew about the thunderstorms before they boarded the aircraft but expected to be able to avoid them.

After departure, the aircraft climbed through layers of stratiform clouds to FL150. Conditions were smooth and no significant weather returns could be detected, on radar, along the intended track. In accordance with normal procedures, the seat belt signs were turned off. As the aircraft approached the Isle of Wight, ATC instructed an initial descent to FL120.

On reaching this level, with the aircraft in cloud, the weather radar indicated a significant weather cell, painting as a red return, further along the route and close to waypoint AVANT. There were also a number of cells, with lower intensity returns, forming a line parallel to the aircraft's track, on the right and about 10 nm away. There appeared to be a gap between the most northerly of these cells and the large cell that was directly ahead. The crew decided to continue on track for a few more miles before asking ATC for a right turn towards this gap. A spell of turbulence was then encountered and the seatbelt signs were turned on. The commander did not foresee a need to suspend the cabin service but the co-pilot did start slowing the aircraft from around 230 KIAS towards 200 KIAS.

After the right turn had been made, the turbulence abated for 20 to 30 seconds. At this stage, the aircraft flew clear of cloud but it then experienced a pronounced downdraught, followed by a strong updraught which caused it to climb rapidly. The autopilot and flight director disengaged, so the co-pilot took manual control. There was then a negative g sensation, as the aircraft left the updraught, and the master warning sounded due to a low oil pressure indication on the left engine. This was a transient warning and the commander reassured the co-pilot that this was a known issue on turboprop aircraft.[1]

The turbulence lasted for around 30 seconds and then, because the aircraft had climbed 780 ft, the co-pilot descended it back to FL120. The flight director and the autopilot were re-engaged about two minutes later. The crew did not advise the altitude deviation or the turbulence encounter to ATC and did not recall ATC making a comment.

Once the autopilot was re-engaged, the commander called the cabin crew. They reported that drinks and small objects had been dislodged in the cabin. The senior cabin crew member had sustained a cut to her leg when one of the trolleys was overturned in the rear galley and her colleague had bumped her head on the ceiling. There was a general level of concern but the passengers were unharmed. The commander then made a passenger address to provide re-assurance and the flight continued to Gatwick, where the passengers were disembarked without further incident.

Following passenger disembarkation, a paramedic attended the aircraft, dressed the cut on the senior crew member's leg and checked that the other crew member had no apparent repercussions after banging her head. The return flight was then postponed, so that relief cabin crew could be positioned to Gatwick. An inspection of the aircraft did not reveal any airworthiness faults.

### Crew comments

Both pilots recalled that the aircraft remained at least 10 nm from the nearest, obvious weather cell and, based on previous experience, the commander did not believe that the cabin service needed to be suspended prior to the upset. The commander commented that the duration of the encounter was very short and did not classify it as severe turbulence.

**Footnote**

[1] The UK Aeronautical Information Circular Pink 56/210, titled '*The Effect of Thunderstorms and Associated Turbulence on Aircraft Operations*', states: *'If negative 'G' is experienced, temporary warnings (eg low oil pressure) may occur. These should be ignored.*'

The co-pilot mentioned that he had completed his line training during the previous summer and had only limited experience of using the weather radar.

**Manufacturer's response**

After reviewing the FDR data for this incident, the manufacturer indicated that recorded load factors remained within the aircraft's promulgated limits. The loads that were encountered induced flight control movements that caused the autopilot and the yaw damper to disengage, in a manner that was consistent with the design criteria.

The low engine oil pressure warning was caused by a -0.3g vertical acceleration. A temporary warning of this nature is considered to be normal behaviour in such circumstances.

**Procedures**

The airline's Operating Manual (OM), recommended that for a '*turbulence encounter*', seat belt signs should be switched on, the igniters turned on continuously and speed reduced to 180 KIAS. The OM also noted that the autopilot may be used, that cabin crew should be warned as early as possible if turbulence was anticipated and, elsewhere, that:

> *'If unexpected turbulence is encountered the Commander must inform the Cabin Crew immediately and tell them whether the service should be continued or not'.'*

In a sub-paragraph about wake turbulence and windshear, pilots were told that they should be familiar with current UK Aeronautical Information Circulars (AICs). The Pink AIC 56/2010, titled '*The Effect of Thunderstorms and Associated Turbulence on Aircraft Operations*', was circulated during pilot conversion training and some of the detail from this AIC was repeated in the OM Part A, together with the following paragraph about turbulence. It stated:

> *'If the weather conditions, cloud structure and route forecast indicate that turbulence is likely, the cabin crew should be pre-warned, and the passengers advised to return to, and/or remain in their seats, and to ensure that their seat belts/harnesses are securely fastened. Catering and other loose equipment should be stowed and secured until it is evident that the risk of further turbulence has passed. Consideration must be given to flying at the recommended turbulence speed/Mach.'*

There was no definition or description in the OM of different levels of turbulence, nor was there a direct instruction to crew that a technical log entry should be made if a specific level of turbulence is encountered. The manual did, however, contain a long list of occurrences that required an MOR to be filed. One example of this was a turbulence encounter that was deemed to require a *'turbulence check'*. No further guidance was provided to crews regarding such a check. In the operator's maintenance manual reference was made to an engineering check to be done when crew reported '*flight in turbulence'.*

The operator's OM Part A provided examples of circumstances that might be regarded as serious incidents. These included:

> *'System failures, weather phenomena, operation outside the approved flight envelope or other occurrences which could have caused difficulties controlling the aeroplane.'*

**AAIB comment**

Pink AIC 56/2010 provides reference material regarding flight in the vicinity of thunderstorms. This event provides evidence that associated turbulence can be encountered some distance from weather cells that are depicted on aircraft radar equipment.

Page GEN 3.5-19 of the UK Aeronautical Information Publication (AIP) includes a stipulation that aircraft are to make special air-reports when the following meteorological phenomena are encountered or observed:

> *'(a) moderate icing (MOD ICE) or severe icing (SEV ICE); or*
> *(b) moderate turbulence (MOD TURB) or severe turbulence (SEV TURB); or*
> *(c) severe mountain wave (SEV MTW); or*
> *(d) thunderstorms with or without hail (that are obscured, embedded, widespread or in squall lines) (TSGR or TS); or*
> *(e) if volcanic ash cloud is observed or encountered, or if pre-eruption volcanic activity or a volcanic eruption is observed to assist other Users, ATS Providers and the Volcanic Ash Advisory Centre (VAAC);'*

The UK AIP then provides table 3.5.6.1 which defines the different intensities of turbulence:

| ***Table 3.5.6.1 – TURB and other Turbulence Criteria Table*** | | |
|---|---|---|
| ***Incidence*** | ***Occasional - less than 1/3 of the time***<br>***Intermittent – 1/3 to 2/3***<br>***Continuous – more than 2/3*** | |
| ***Intensity*** | ***Aircraft Reaction (transport size aircraft)*** | ***Reaction Inside Aircraft*** |
| *Light* | *Turbulence that momentarily causes slight, erratic changes in altitude and/or attitude (pitch, roll, yaw)*<br>*IAS fluctuates 5 -15 kt. (<0.5 g at the aircraft's centre of gravity) Report as '**Light Turbulence**'. or;*<br>*turbulence that causes slight, rapid and somewhat rhythmic bumpiness without appreciable changes in altitude or attitude. No IAS fluctuations. Report as '**Light Chop**'* | *Occupants may feel a slight strain against seat belts or shoulder straps. Unsecured objects may be displaced slightly. Food service may be conducted and little or no difficulty is encountered in walking.* |

| *Table 3.5.6.1 – TURB and other Turbulence Criteria Table (Cont)* | | |
|---|---|---|
| *Moderate* | *Turbulence that is similar to Light Turbulence but of greater intensity. Changes in altitude and/or attitude occur but the aircraft remains in positive control at all times. IAS fluctuates 15-25 kt. (0.5-1.0g at the aircraft's centre of gravity). Report as '**Moderate Turbulence**'. or;*<br><br>*turbulence that is similar to Light Chop but of greater intensity. It causes rapid bumps or jolts without appreciable changes in altitude or attitude. IAS may fluctuate slightly. Report as '**Moderate Chop**'.* | *Occupants feel definite strains against seat belts or shoulder straps. Unsecured objects are dislodged. Food service and walking are difficult.* |
| *Severe* | *Turbulence that causes large, abrupt changes in altitude and/or attitude. Aircraft may be momentarily out of control. IAS fluctuates more than 25 kt. (> 1.0 g at the aircraft's centre of gravity). Report as '**Severe Turbulence'*** | *Occupants are forced violently against seat belts or shoulder straps. Unsecured objects are tossed about. Food service and walking impossible.* |
| *Note: Pilots should report location(s), time(s) (UTC), incidence, intensity, whether in or near clouds, altitude(s) and type of aircraft. All locations should be readily identifiable. Turbulence reports should be made on request, or in accordance with paragraph 6.2. Example: (a) Over Pole Hill 1230 intermittent Severe Turbulence in cloud, FL 310, B747. (b) From 50 nm north of Glasgow to 30 nm west of Heathrow 1210 to 1250, occasional Moderate Chop TURB, FL 330, MD80. Note: The UK does not use the term 'Extreme' in relation to turbulence.* | | |

**Safety action**

After this event, the operator conducted an internal investigation. This resulted in changes to the Part A of their Operations Manual and the inclusion of an instruction that pilots must inform ATC, immediately, of any unauthorised vertical deviation of more than 300 ft (200 ft when within reduced vertical separation minima airspace). The detailed guidance from the UK AIP, regarding special air reports and turbulence levels, was also placed into the Part A.

Additionally, the operator intended to enhance the training package given to pilots on the use of weather radar and to review its guidance concerning serious incidents.