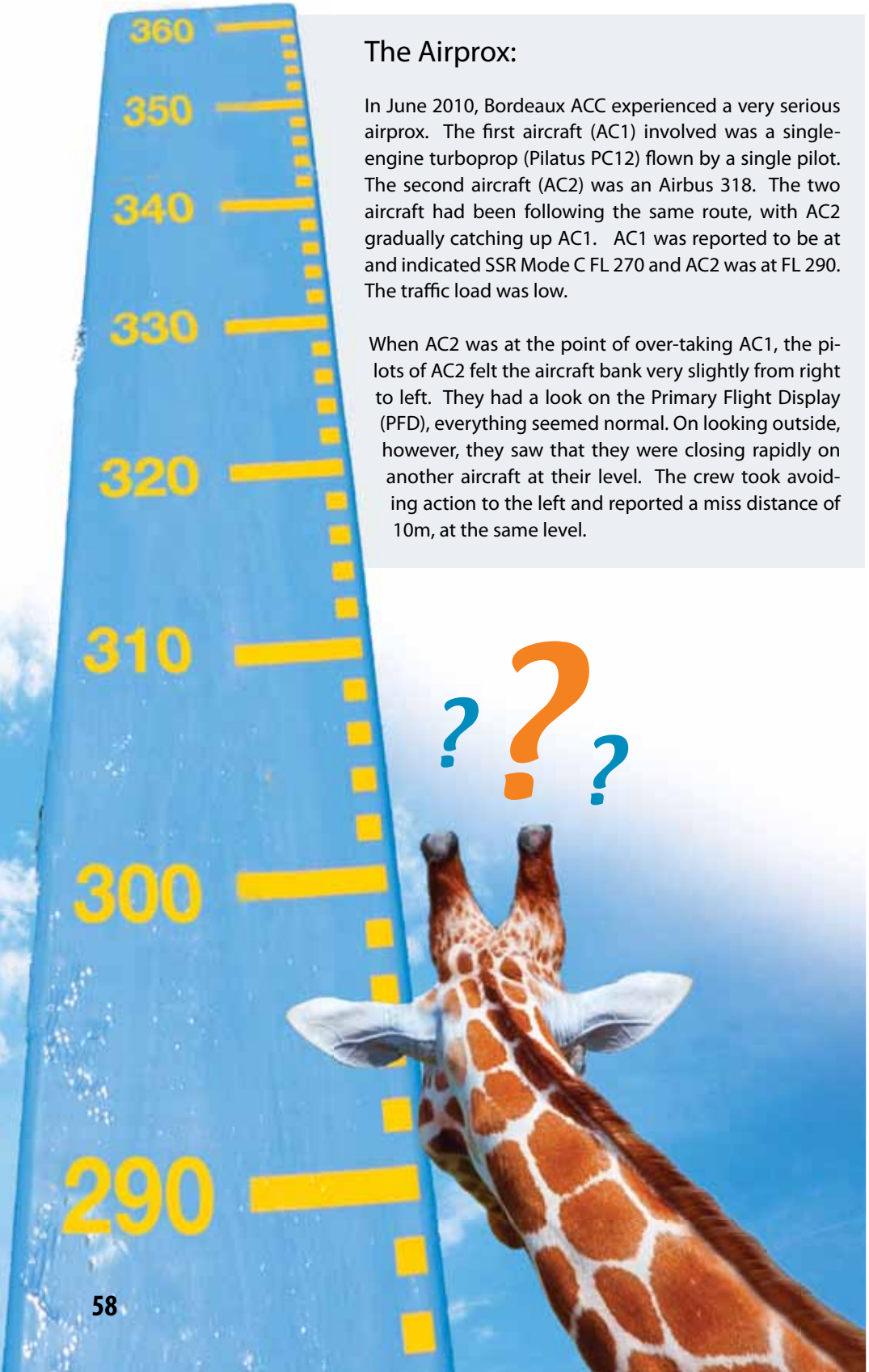
AIRPROX - Altimeter System Error

What's my level?

By Chantal Bonnet - DSNA



The Airprox:

In June 2010, Bordeaux ACC experienced a very serious airprox. The first aircraft (AC1) involved was a single-engine turboprop (Pilatus PC12) flown by a single pilot. The second aircraft (AC2) was an Airbus 318. The two aircraft had been following the same route, with AC2 gradually catching up AC1. AC1 was reported to be at and indicated SSR Mode C FL 270 and AC2 was at FL 290. The traffic load was low.

When AC2 was at the point of over-taking AC1, the pilots of AC2 felt the aircraft bank very slightly from right to left. They had a look on the Primary Flight Display (PFD), everything seemed normal. On looking outside, however, they saw that they were closing rapidly on another aircraft at their level. The crew took avoiding action to the left and reported a miss distance of 10m, at the same level.

What happened before?

After take-off, in contact with Skyguide, when AC1 was stable at FL100, the pilot reported a discrepancy between the two altimeters fitted on the aircraft. The pilot asked ATC to check that the aircraft was at FL 100 and this was confirmed by the controller.

AC1 was then transferred to Marseille ACC. The pilot did not report any altimeter problems while in contact with Marseille ACC.

AC1 was then transferred to Bordeaux ACC with SSR Mode C indicating FL270. This was confirmed and verified on first contact. A few minutes later, the pilot of AC1 reported to ATC that he had a discrepancy in the displayed altitude on his two altimeters: one indicated FL270 and the other FL290. He asked ATC if they could check his altitude if he put his Mode C on Standby. At that moment, there was no other traffic in the vicinity of AC1, and so there was no need to effect any horizontal separation. The controller, aware that military control centres were equipped with primary height-finding radar able to evaluate an altitude, decided to check AC1's altitude with his military colleagues.

This initiated a complex co-ordination sequence involving 3 intermediaries about a request to check AC1's altitude by a source other than that used to derive the Mode C data being displayed to the Bordeaux controller. During this period, AC2 made its first contact with the Bordeaux controller and was cleared to FL 290. After approximately another 3 minutes, the Bordeaux controller received confirmation from the military

Further Reading:

- **ICAO Annex 6 – Operation of Aircraft**

- **SKYbrary articles:**
  - Altimeter System Error
  - Height Monitoring Units
  - RVSM
  - Aircraft Technical Equipment
  - EFIS
  - Altitude Alerter
  - EU OPS

that AC1 was at exactly FL 270! However, it later transpired that the source used for the cross-check was the same as that used by the Bordeaux controller (i.e. SSR derived Mode C data). Unaware of this and believing AC1 to be at FL270, the controller still did not consider it necessary to build in any horizontal separation between AC1 and AC2 which was by then at FL290 and following AC1 on the same route.

The airprox occurred ten minutes after the (false) cross-check. Neither STCA nor TCAS was triggered!

Finally, ten minutes after the event, the pilot of AC1 manually selected the second altimeter for Mode C and the aircraft was displayed at FL290 on the radar screens.

Analysis:

The investigation and analysis of the incident by BEA (French AIB) and DSNA identified a number of key points:

- The altimeter failure was due to a leak in the static circuit No. 1 (pilot's circuit). This leak was located on a short plastic connector that links the static circuit with the cabin differential pressure indicator.
- There is no set procedure for the PC12 to help pilots determine which altimeter displays the most reliable information in these circumstances.
- There is no ICAO procedure related to this situation (i.e. when the pilot is unable to determine his altitude due to discrepancy in altimeter readings), which is completely different from controllers verifying Mode C indications.
- The pilot did not declare any state of urgency (the flight had been controlled with a critical altitude error for more than 35 minutes in airspace that is usually very busy).
- Some primary height-finding radar can evaluate the altitude of a flight but this information is not accurate enough to be used for separation (the error is generally more than 2000 ft).
- Ground-to-ground communications can be complex. Safety-related information must be passed on accurately from one agency to another or from one sector to another.
- Altimeter System Error can negate the benefits of safety nets such as STCA and ACAS.
- ATCOs and pilots can be 'surprised' if they do not maintain an understanding and/or knowledge of how certain ground and airborne systems work and how they may interact with each other.

Mitigations and lessons learned:

- ATC relies on the altitude/height information provided by the pilot/aircraft systems for the safe provision of ATS. However, there is no independent means available to determine the veracity of the information. When a pilot asks a controller to confirm his/her altitude, because there is a discrepancy in altimeter readings, this should not be considered as a routine situation.

What can be done by ATC when the pilot confirms the problem?

- Establish horizontal separation.
- Ask the pilot to stop Mode C.
- Inform the pilot that it is not possible to determine his/her altitude.
- Inform other sectors/centres.
- Depending on the severity of the situation:
  - Ask the pilot to select Mode A 7700.
  - Provide flight assistance – if practicable arrange an escort aircraft, help the pilot to remain in VMC.

Internally, important efforts have been made to learn lessons from this incident and provide feedback to ATCOs.

During the period 2009/2010, two other occurrences when pilots informed ATCOs that they were not sure about their altitude were reported. However, unlike the incident described above, in those particular cases, the displayed altitudes turned out to be correct.

Chantal Bonnet

She is the head of Safety Analysis Unit in Bordeaux ACC. Previously she was an ATCO in Paris ACC then in Bordeaux ACC. In Bordeaux ACC she became an ATC Supervisor and also FMP manager.

EDITORIAL NOTE

One important point in this account insofar as it has wider implications for us all is the number of (serviceable) barometric altimeters on the flight deck. Some small aircraft like the PC12 will often only have two even though they are sometimes flown IFR in Controlled Airspace, whereas larger aircraft will have three. Having three altimeters means that, in the event of the malfunction of a single instrument, cross checking will disclose the problem and the majority reading (two out of three the same) will easily determine which one is unreliable and can be ignored, with one of the serviceable ones selected as the height encoding source. ATC do not need to know.