

## Aircraft Accident Report No: 1/2014

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on the AAIB Website: www.aaib.gov.uk*

### Report on the accident to Airbus A330-343, G-VSXY London Gatwick Airport 16 April 2012

**Registered Owner and Operator:** Virgin Atlantic Airways

**Aircraft Type:** Airbus A330-343

**Nationality:** British

**Registration:** G-VSXY

**Place of Accident:** London Gatwick Airport

**Date and Time:** 16 April 2012 at 1131 hrs

### Synopsis

The Air Accidents Investigation Branch (AAIB) was notified of this occurrence by Virgin Atlantic Airways shortly after it happened and the investigation was started the same day.

The occurrence was initially classified by the AAIB as a Serious Incident. However, when it became clear that two passengers had incurred injuries defined as Serious, the occurrence was reclassified as an Accident, in accordance with ICAO Annex 13 and the United Kingdom's 'Civil Aviation (Investigation of Air Accidents and Incidents) Regulations 1996'. This classification as an Accident does not reflect the state of the aircraft, which sustained only very minor damage, during the evacuation.

In accordance with established international arrangements, the Bureau d'Enquêtes et d'Analyses (BEA) in France, representing the State of Design and Manufacture of the aircraft, appointed an Accredited Representative and was supported by a team which included advisors from Airbus, the aircraft manufacturer, and Siemens, systems manufacturer. The aircraft operator has co-operated with the investigation and provided expertise as required. The Civil Aviation Authority (CAA) and the European Aviation Safety Agency (EASA) have been kept informed of developments.

The aircraft was operating a flight from London Gatwick Airport to McCoy International Airport in Orlando, USA with three flight crew, 10 cabin crew and 304 passengers on board including three infants. Early in the flight the crew received a series of smoke warnings from the aft cargo hold and the commander elected to return to London Gatwick. The crew carried out the appropriate emergency drills, including the discharge of the fire extinguishers in the aft cargo hold, but the smoke warnings continued. The aircraft landed safely, the crew brought it to a halt on the runway and endeavoured to establish the extent of any fire. This produced conflicting evidence and, with smoke warnings continuing, the commander ordered an emergency evacuation.

The passengers all left the aircraft within 90 seconds but two injuries, classed as 'Serious', were incurred. Subsequent examination of the aircraft and its systems showed that the smoke warnings had been spurious.

The investigation identified that injuries were sustained during the evacuation of the aircraft. The evacuation was initiated based on the commander's assessment of the available sources of information, including the repetitive and intermittent nature of the aft cargo smoke warnings.

The investigation identified the following causal factor for the intermittent cargo smoke warnings:

- (i) A latent fault on the T1 thermistor channel of smoke detector 10WH, in combination with a CAN Bus fault and possible high levels of humidity in the cargo compartment due to the carriage of perishable goods, provided circumstances sufficient to generate multiple spurious aft cargo compartment smoke warnings.

The investigation identified the following contributory factors for the intermittent cargo smoke warnings:

- (i) The thermal channel fault in 10WH was not detected prior to the event by the internal smoke detector temperature monitoring.
- (ii) The proximity of the fire extinguisher nozzles to the smoke detectors.

## Findings

### *Operational aspects*

1. The crew experienced a SMOKE AFT/BULK CARGO SMOKE Master Warning 15 minutes into the flight which repeated intermittently until just before the evacuation.
2. The crew carried out the appropriate ECAM actions in relation to the Master Warning which included discharging fire extinguishing agent into the aft cargo hold.
3. The message that there was smoke in the cargo hold was misunderstood by Brest ATC and corrupted during onward transmission leading to the RFFS at London Gatwick airport positioning fire vehicles at the wrong end of the aircraft.
4. Cabin crew reported to the incorrect location on the aircraft for their brief by the FSM.
5. Once the aircraft had come to a halt on the runway, the commander instructed the cabin crew to stand down rather than stand by.

6. The escape slide at Door 4R did not fully inflate which rendered the exit unusable.
7. The evacuation was completed in 109 seconds, with most passengers out within one minute.
8. There was confusion between the incident commander on the ground and the ATC Watch Manager, as to the correct status of the incident. Consequently, there was a delay in passing a message to relevant emergency and support agencies that there had been an evacuation on the runway.
9. The RFFS found no evidence of smoke or heat spots in the aircraft.

*Technical aspects - general*

10. The aircraft was certified, equipped and maintained in accordance with the applicable regulations.
11. There was no evidence of fire, smoke or heat damage in the aft cargo compartment.
12. The aircraft was carrying a cargo largely comprised of perishable goods.
13. Fifteen separate aft cargo smoke warnings were generated during the flight. They were determined to be spurious warnings.

*Technical aspects - smoke detection system*

14. Redundancy in the SDS was lost at electrical power-up during the incident sector due to a CAN Bus A wiring fault, resulting in the SDS operating in single detection mode.
15. Redundancy in the SDS was restored at the subsequent electrical power-up.
16. Inspection of the CAN Bus A wiring did not reveal any wiring anomalies.
17. The root cause for the CAN Bus A fault has not been determined.
18. The aircraft manufacturer identified an unexpectedly high rate of similar CAN Bus faults across the A330 global fleet. These faults are under investigation.

*Technical aspects - smoke detectors*

19. The initial smoke warnings were initiated by smoke detector 10WH.
20. Smoke detector 10WH generated 12 of the smoke warnings. 10WH NVM was not available for the incident sector, however it is likely that these were all thermal alarms.
21. Three additional optical alarms were generated by smoke detectors 6WH and 8WH, as a result of the fire extinguishing agent discharge.

22. Release of the halon fire extinguishing agent resulted in damage to the humidity sensors of the 7WH and 8WH smoke detectors and resulted in them becoming DEGRADED.
23. Release of the halon fire extinguishing agent resulted in smoke detector 6WH temporarily becoming DEGRADED, due to a localised temperature drop below the operating range of the temperature sensors.
24. The insulation resistance of the 9WH and 10WH T1 thermistors was compromised by damage to the insulating envelope, which exposed the active area of the thermistor to the external environment.
25. The damage to the insulating envelope degraded the electrical characteristics of the 9WH and 10WH T1 thermistors, such that the resistance response, and consequently the measured temperature value for a given temperature, was inaccurate.
26. The investigation was not able to determine the cause of the damage to the Kapton film of the 9WH and 10WH T1 thermistors.
27. The investigation was not able to reproduce a reduction in thermistor electrical performance, even on thermistors with intentionally induced damage.
28. Acceptance Test Procedures did not detect the faults on the 9WH and 10WH T1 thermistors.
29. The smoke detector internal temperature monitoring did not detect the faults on the 9WH and 10WH T1 thermistors.
30. The T1 thermistors from 9WH and 10WH were part of a batch manufactured in 2008.
31. One other thermistor examined in the course of the investigation exhibited similar damage to that on the 9WH and 10WH T1 thermistors, and a similar deterioration of the thermistor's electrical performance. It had been subject to chemical spray during smoke detector qualification testing.
32. Bubbles were present in the insulating envelope of the T1 thermistors from 9WH and 10WH, and other thermistors examined in the course of the investigation.
33. Thermistors removed from in-service smoke detectors contained a greater number and larger size bubbles than new thermistors from stock.
34. The presence of the bubbles did not, in isolation, have any impact on the electrical characteristics of the thermistors, when tested.
35. A previously identified issue with silicon coating at the junction of the thermistors and the measurement board could not be ruled out as a contributory factor.

### *Technical aspects - escape slide-raft findings*

36. The R4 slide-raft did not fully inflate and consequently the R4 exit was not available during the emergency evacuation.
37. The secondary restraint on the R4 slide-raft was unbroken.
38. The partial inflation of the R4 slide-raft most likely resulted from a packing fold, which caused early release of the primary restraint and non-release of the secondary restraint.
39. The R4 slide-raft was manufactured and packed before a change to packing instructions was implemented, to address previous similar partial inflations.

### **Safety Recommendations**

The following Safety Recommendations were made at the time of publication:

#### **Safety Recommendation 2014-005**

It is recommended that the European Aviation Safety Agency amend AMC1 CAT.OP.MPA.170, 'Passenger briefing', to ensure briefings emphasise the importance of leaving hand baggage behind in an evacuation.

#### **Safety Recommendation 2014-006**

It is recommended that the European Aviation Safety Agency develops recommendations on the content of visual aids such as safety briefing cards or safety videos to include information on how passengers, including those with young children, should use the escape devices.

#### **Safety Recommendation 2014-007**

It is recommended that Airbus determine the causes of erroneous Controller Area Network (CAN) Bus faults and implement solutions to eliminate such faults.

#### **Safety Recommendation 2014-008**

It is recommended that Airbus amend the dispatch criteria for aircraft with single Controller Area Network (CAN) Bus faults, until such time as the causes of erroneous CAN Bus faults have been identified and addressed.

#### **Safety Recommendation 2014-009**

It is recommended that Siemens amend the Component Maintenance Manual procedures for multi-criteria smoke detectors returned for overhaul, or issue a service letter, to improve fault detection of thermal channel hardware failures which can lead to inaccurate temperature measurement.

**Safety Recommendation 2014-010**

It is recommended that Airbus introduce a maintenance requirement so that, following an activation of the Lower Deck Cargo Compartment (LDCC) fire extinguishing system in an aircraft equipped with multi-criteria smoke detectors, all smoke detectors in the affected cargo compartment are removed for examination and overhaul.

**Safety Recommendation 2014-01**

It is recommended that the European Aviation Safety Agency review the certification requirements for the location of fire extinguisher nozzles in relation to the smoke detectors, on aircraft equipped with multi-criteria smoke detectors, in order to minimise the adverse effects associated with activation of the fire extinguishing system.