



Australian Government
Australian Transport Safety Bureau

Air data system failure involving Airbus A330-243 A6-EYJ

near Brisbane Airport, Queensland | 21 November 2013



Investigation

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Addendum

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Safety summary

What happened

On 21 November 2013, after a flight from Singapore, an Etihad Airways Airbus A330, A6-EYJ landed at Brisbane airport and was taxied to the terminal. Approximately 2 hours later, the aircraft was pushed-back from the gate for the return flight to Singapore.

The captain rejected the initial take-off attempt after observing an airspeed indication failure on his display. The aircraft taxied back to the terminal where troubleshooting was carried out, before being released back into service.

During the second take-off roll, the crew became aware of an airspeed discrepancy after the V_1 decision speed and the take-off was continued. Once airborne, the crew declared a MAYDAY and decided to return to Brisbane where an overweight landing was carried out.

A330 at the gate



Source: ATSB

What the ATSB found

Engineering inspection after the overweight landing found that the Captain's pitot probe was almost totally obstructed by an insect nest, consistent with mud-dauber wasp residue. The pitot obstruction had occurred during the 2 hour period that the aircraft was on the ground at Brisbane and was not detected during troubleshooting after the initial rejected take-off.

What's been done as a result

The aircraft operator has changed its policy on the use of pitot covers. They are now required to be used on all transits at Brisbane Airport, regardless of ground time.

The aircraft manufacturer has amended its maintenance troubleshooting manual to increase the likelihood that a blocked pitot probe will be detected.

The airport operator has extended its wasp inspection and eradication program and reviewed and updated its Wildlife Hazard Management Plan.

In addition, CASA has drawn attention to the safety implications of mud wasp activity through several publications.

Safety message

Operators can minimise the risk of pitot probe obstruction by consistently using pitot covers even during short transit periods.

Standard operating procedures include the cross-checking of airspeed during the take-off roll. These checks are an important last line of defence in preventing an aircraft from becoming airborne with airspeed indication problems.

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The occurrence

On 21 November 2013, after a flight from Singapore, an Etihad Airways A330, registered A6-EYJ, landed at Brisbane Airport and was taxied to the terminal. It came to a stop at 0949 EST.¹ Pitot probe covers were not used during the transit. At 1152 EST, the aircraft was pushed-back for the return flight to Singapore. The captain rejected the initial take-off attempt on runway 01 after observing that there was an airspeed indication failure² on his primary flight display (PFD). The maximum airspeed recorded by the flight data recorder during the rejected take-off was 88 kt.

The aircraft taxied back to the terminal where troubleshooting was carried out. As part of the troubleshooting, air data inertial reference unit (ADIRU) 1 and ADIRU 2 were transposed and the aircraft was dispatched with the air data reference (ADR) part of ADIRU 2 inoperative, which was in accordance with the MEL.³ The first officer's (FO's) air data⁴ source was switched to ADIRU 3 and the captain's air data source remained switched to the normal (ADIRU 1) position.

At 1345, the crew commenced the second take-off on runway 01, with the captain performing the pilot flying (PF) duties and the FO performing the pilot monitoring (PM) duties. During the take-off roll the crew reported that they became aware of an airspeed discrepancy after V_1 ,⁵ and the take-off was continued. As a result of the airspeed discrepancy, the autothrust system and flight directors disengaged automatically. Once airborne, the auto-flight system reverted from normal law to alternate law for the remainder of the flight. At this time, the captain handed over control of the aircraft to the FO.

While climbing through a pressure altitude of 1,360 ft, the slat/flap lever was moved from the CONF1 to the 0 (up) position and the flaps began to retract, but the slats remained extended.⁶ For a 2-minute period, a V_{FE} ⁷ warning occurred as the slat limit speed was exceeded.

At 1347:30, the captain took over control of the aircraft for the remainder of the flight. Shortly afterwards, the crew declared a MAYDAY⁸ and decided to return to Brisbane. The aircraft was manoeuvred to the east of the airport and maintained an altitude of approximately 2,000 ft. At 1351:36 the air data selector was switched to the 'CAPT ON 3' position and remained in that position for the remainder of the flight.

An overweight landing⁹ was subsequently carried out on runway 01 and the aircraft taxied clear of the runway with the aviation rescue and fire-fighting (ARFF) services in attendance. The aircraft then taxied back to the terminal.

¹ Eastern Standard Time (EST) was Coordinated Universal Time (UTC) + 10 hours.

² The captain reported that a red SPD (speed) flag was shown.

³ A minimum equipment list (MEL) is a list of aircraft equipment and systems that may be inoperative for flight, subject to specified conditions.

⁴ Air data includes parameters such as pressure altitude, airspeed, angle of attack and air temperature.

⁵ V_1 is the critical engine failure speed or decision speed. Engine failure below this speed shall result in a rejected take-off; above this speed the take-off run should be continued.

⁶ This was a consequence of the activation of the Slats Speed Lock function. Slat Flap Control Computers (SFCCs) use consolidated airspeed information from the three ADIRUs to inhibit slat retraction to prevent a possible stall. If the consolidated calibrated airspeed (CAS) is below 148 kt, then slat retraction from position 1 to 0 is inhibited. In this case, as valid CAS data was only received from two ADIRU's, then the consolidated CAS used by the SFCCs was the lower of the two. The slat retraction inhibition is no longer active when the consolidated CAS exceeds 154 kt and the slats will automatically retract.

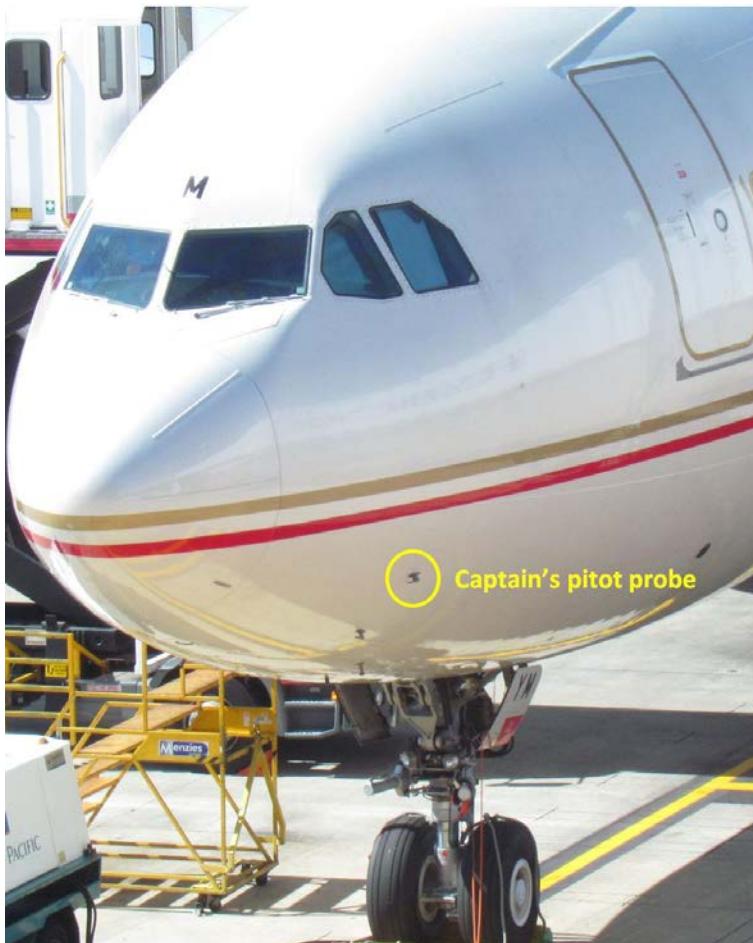
⁷ V_{FE} is the maximum speed with the flaps/slats extended. A V_{FE} Warning triggered as soon as one of the three CAS values was higher than the V_{FE} Warning threshold ($V_{FE} + 4$ kt). At that time, the aircraft was in conf. 1 with an integrated standby instrument system (ISIS) CAS (equivalent to CAS3) of 246 kt. The V_{FE} conf. 1 is 240 kt. Therefore, CAS3 was higher than the V_{FE} Warning threshold (244 kt).

⁸ MAYDAY is an internationally recognised radio call for urgent assistance.

⁹ The actual landing weight was 199.7 tonnes while the maximum landing weight was 182 tonnes. After an overweight landing, depending on the vertical speed and acceleration at touchdown, an aircraft inspection may be required.

Subsequent visual inspection of the pitot probes found that there was an internal obstruction of the captain's probe (Figure 1), while the FO and standby probes were clear.

Figure 1: Location of the captain's pitot probe



Source: ATSB

Context

Airspeed measurement on the A330

The A330 has three independent systems for calculating and displaying airspeed information: (1) captain, (2) first officer, and (3) standby systems. Each system uses its own pitot probe, static ports, air data modules (ADMs), air data inertial reference unit (ADIRU), and airspeed indicator.

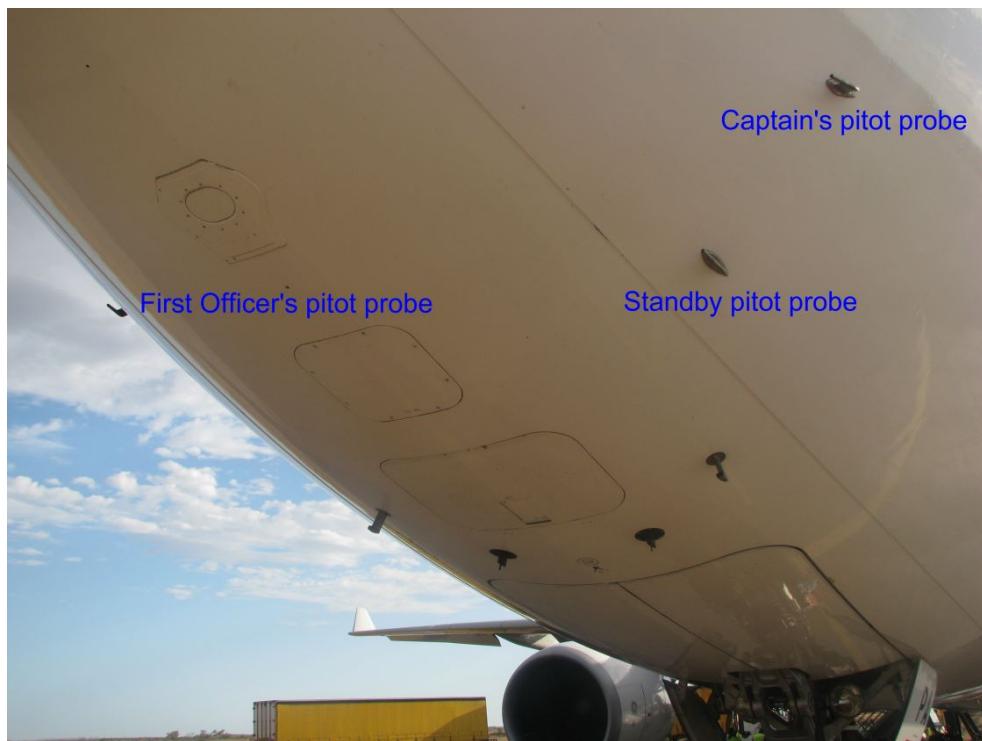
Each ADIRU comprises two parts, an air data reference (ADR) part and an inertial reference (IR) part which are integrated into a single unit. One part can be switched off while the other part can still operate.

Airspeed is measured by comparing total air pressure (P_t)¹⁰ and static air pressure (P_s). On the A330, P_t was measured using a pitot probe, and P_s was measured using two static ports. A separate ADM was connected to each pitot probe and each static port, and it converted the air pressure from the probe or port into digital electronic signals.

Each pitot probe consisted of a tube that projected several centimetres out from the fuselage, with the opening of the tube pointed forward into the airflow. The tube had drain holes to remove moisture, and it was electrically heated to prevent ice accumulation during flight.

The locations of the aircraft's pitot probes are shown in Figure 2.

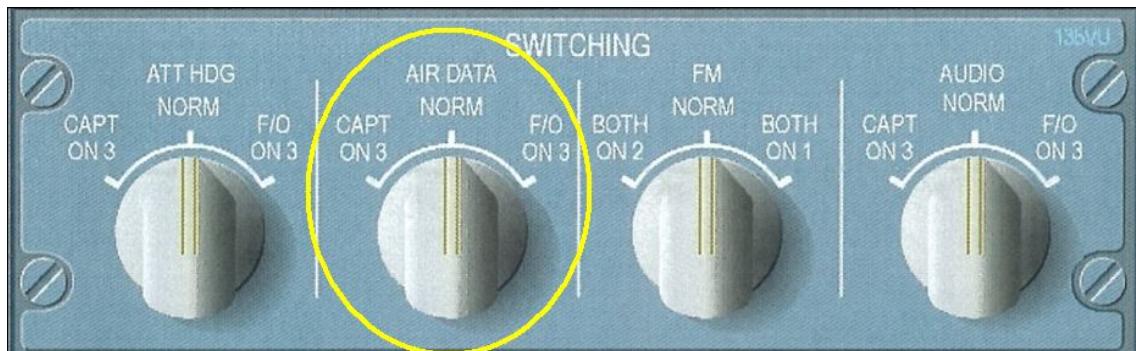
Figure 2: Locations of pitot probes



Source: ATSB

Normally, the airspeed displayed to the captain uses the captain's pitot probe and ADIRU 1, but the source can be manually switched by the crew to the standby system (standby pitot probe and ADIRU 3) if required. Similarly, the airspeed displayed to the first officer (FO) normally uses the first officer's pitot probe and ADIRU 2, but the source can be manually switched by the crew to the standby system if required (Figure 3).

¹⁰ P_t is the sum of static (or outside) air pressure and pressure due to relative airspeed.

Figure 3: Air Data Switching

Source: ATSB

Flight control system

The Airbus A330 had fly-by-wire flight controls. The aircraft's flight control surfaces were electrically controlled and hydraulically activated, and flight control computers processed pilot and autopilot inputs to direct the control surfaces as required. There were three flight control primary computers (FCPCs) and two flight control secondary computers (FCSCs).

The FCPCs continuously monitored outputs from the three ADIRUs. The median (voted) value of each parameter was compared to each individual value. If the difference was above a predetermined threshold for a predetermined confirmation time, then the associated part of that ADIRU (IR or ADR) was rejected and the two remaining sources were used for flight control purposes.

The flight control system operated according to normal, alternate or direct control laws. Under normal law, the computers prevented the exceedance of a predefined safe flight envelope. If various types of aircraft system problems were detected, then the control law reverted to alternate law. Under alternate law, some of the protections were not provided or were provided with alternate logic. Under direct law, no protections were provided and control surface deflection was proportional to sidestick and pedal movement by the flight crew.

During the second take-off at 1345, the active control law changed from normal law to alternate law (for 8 seconds) then back to normal law (4 seconds) and finally back to alternate law. The second reversion to alternate law was latched for the remainder of the flight.

Flight guidance system

The flight guidance system used two independent flight management, guidance and envelope computers (FMGECs). The flight guidance part of each computer controlled the autopilot, autothrust and flight director (FD) functions. Flight director 1 displayed control orders from FMGEC 1 on the captain's PFD and flight director 2 displayed control orders from FMGEC 2 on the first officer's PFD.

Both FMGECs continuously monitored the altitude and computed airspeed from all three ADRs. During the second take-off at 1345, ADR2 was already rejected due to being switched off. When the FMGEC then detected a difference above the threshold between the two remaining ADRs, the autothrust and associated flight directors were automatically disconnected.

Maintenance action following the rejected take-off

Following the rejected take-off, the fault symptoms provided to the maintenance engineers were a combination of crew observations and messages from the on-board central maintenance system (CMS). The CMS enabled troubleshooting and return-to-service testing to be carried out rapidly from the flight deck. The hub of the CMS was the central maintenance computer, which assisted in the diagnosis of faulty systems.

Central maintenance computer (CMC)

Each aircraft system has built-in test equipment (BITE) which is used to test system components and detect faults, and to confirm system operation following any maintenance. Each of the aircraft's systems communicates with the CMC and sends it information on detected faults and any warnings indicated to the flight crew.

When the aircraft was on the ground, maintenance engineers could access the CMC using a multi-purpose control and display unit (MCDU) from the flight deck and obtain information from the most recent flight or earlier flights. Through using the MCDU, BITE information from aircraft systems could be interrogated and the systems tested.

Aircraft systems could detect faults in two ways: internally, by monitoring its own operation, or externally, by another aircraft system which received and monitored information from the 'faulty' system.

Post flight report (PFR)

The CMC produced various reports that were accessible through the MCDU when the aircraft was on the ground. Those reports included the post flight report (PFR), which was produced and printed at the end of a flight. The PFR contained fault information received from other aircraft systems' BITE and which was sent to the CMC during flight. The PFR showed one fault:

ADIRU1 (1FP1) BUS ADR

This had been reported by the electrical flight control system (EFCS) and was a Class 2 message. Class 2 messages are not presented to the crew during flight (including take-off). Associated with the fault message were two maintenance status messages:

MAINTENANCE STATUS EFCS 1

MAINTENANCE STATUS EFCS 2

Trouble Shooting Manual (TSM)

Trouble shooting is performed using the TSM. Crew observations and/or PFR items are used as entry points to the TSM. Accordingly, either of the following two TSM entries could have been used:

- The RED SPD FLAG on CAPT PFD in the "EFIS PFD" part, and/or
- The Maintenance message "ADIRU1 (1FP1) BUS ADR" in the "CMS Fault Messages" part.

These two symptoms are linked respectively to the following TSM tasks:

- TSM Task 34-10-51-810-907-A "Loss of the AIR/GND signal in the DMC1", with the following possible causes:
 - Display Management Computer 1 (DMC 1), or
 - Wiring between the DMC1 and the first terminal block.
- TSM task 27-90-00-810-889-A "Failure of the ADIRU 1 ADR Bus on the FCPCs", with the following possible causes:
 - ADIRU-1, or
 - Angle of Attack (AOA) sensor.

This last TSM task refers to the ADIRU 1 as a possible cause and asks for a BITE test of the EFCS to confirm the fault.

The aircraft maintenance engineer reported that the second task was performed and the EFCS 1 and 2 BITE tests did not confirm any faults i.e. the units tested with normal indications.

Although no faults had been positively identified, the engineer considered that ADR 1 was inoperative and transposed ADIRU 1 and 2. The aircraft was dispatched with the ADR part of

ADIRU 2 inoperative, in accordance with the MEL. The FO's air data source was switched to ADIRU 3 and the captain's air data source remained switched to the normal (ADIRU 1) position.

Service Information Letter (SIL) 34-084 “Erratic Airspeed Indication Maintenance Actions”

Neither of the two relevant TSM tasks identified the pitot probes as a possible root cause of the airspeed indication failure. However, on 15 January 2013, Airbus issued Revision 7 of Service Information Letter (SIL) 34-084: *Erratic Airspeed Indication Maintenance Actions* on that subject, which provided operators with comprehensive maintenance recommendations in case of airspeed problems. One of these recommendations (SIL chapter 4.2.2) indicated that in case of a RTO due to a discrepancy between the captain's and FO's indicated airspeed, the TSM tasks linked to the PFR have to be performed but operators are also recommended to focus on specific tasks related to pitot probes (detailed in the SIL).

Airspeed checks by the crew during take-off

The operator's standard operating procedures (SOP's) were based on those of the manufacturer and included the following references to airspeed:

Figure 4: Extract from standard operating procedures for take-off

BEFORE REACHING 80 KNOTS	
TAKEOFF N1	CHECK
Check that the actual N1 of the individual engines has reached the N1 rating limit, before the aircraft reaches 80 kt. Check EGT.	PM
THRUST SET	ANNOUNCE
PFD and ENG indications	SCAN
– Scan airspeed, N1, and EGT throughout the takeoff.	PM
Applicable to: ALL	
REACHING 100 KNOTS	
ONE HUNDRED KNOTS	ANNOUNCE
<ul style="list-style-type: none"> The PF crosschecks and confirms the speed indicated on the PFD. Below 100 kt, the Captain may decide to abort the takeoff, depending on the circumstances. Above 100 kt, rejecting the takeoff is a more serious matter. 	PM
Applicable to: ALL	

Source: ATSB

The aircraft manufacturer also provided the following generic guidelines (extracted from FCOM PRO-ABN-10 - Operating Techniques – Rejected Take-off):

Below 100 knots

The decision to reject the take-off may be taken at the Captain's discretion, depending on the circumstances.

The Captain should seriously consider discontinuing the take-off, if any ECAM warning/caution is activated. The speed of 100 kt is not critical, and was chosen in order to help the Captain make his/her decision and avoid unnecessary stops from high speed.

Above 100 knots and below V_1^{11} :

Rejecting the take-off at these speeds is a more serious matter, particularly on slippery runways, and it could lead to a hazardous situation if the speed is approaching V_1 . At these speeds, the Captain should be “go-minded” and very few situations should lead to the decision to reject the take-off:

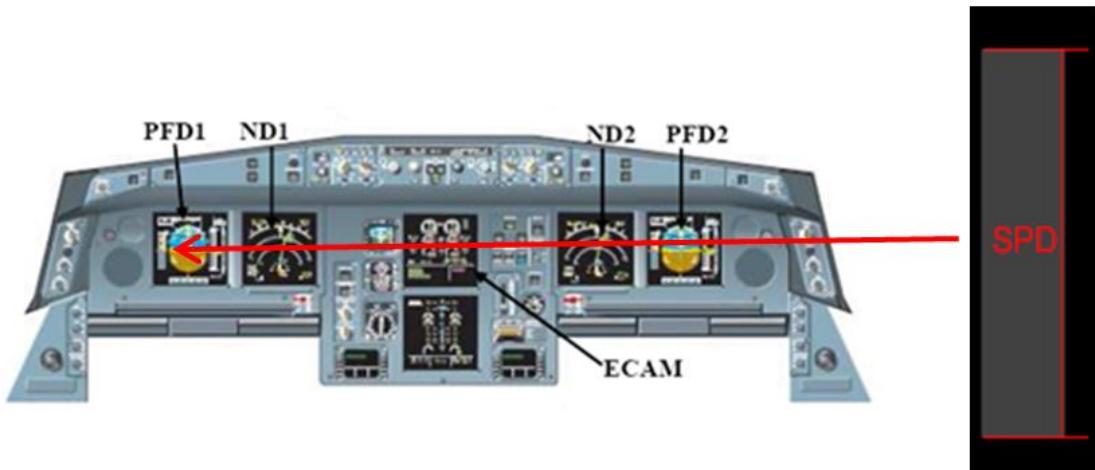
¹¹ The internationally accepted standard definition of V_1 is the airspeed that defines a decision point during a take-off at which, should a critical engine fail, a pilot can elect to abandon or continue the take-off.

1. Fire warning, or severe damage
2. Sudden loss of engine thrust
3. Malfunctions or conditions that give unambiguous indications that the aircraft will not fly safely
4. Any red ECAM warning
5. Any amber ECAM caution of the ENG system or the F/CTL (flight control) system.

Red speed flag

During the RTO the crew reported that a red speed (SPD) flag appeared on the captain's PFD (Figure 5). One of the conditions for displaying this flag is that no valid¹² airspeed data was available from ADR 1 at the same time as ground speed data was valid and greater than 50 kt. The flight data (Figure 6) showed that CAS sourced from ADR1 (i.e. the CAS that was displayed on the captain's PFD) was zero when ground speed increased through 50 kt and this is consistent with the crew report.

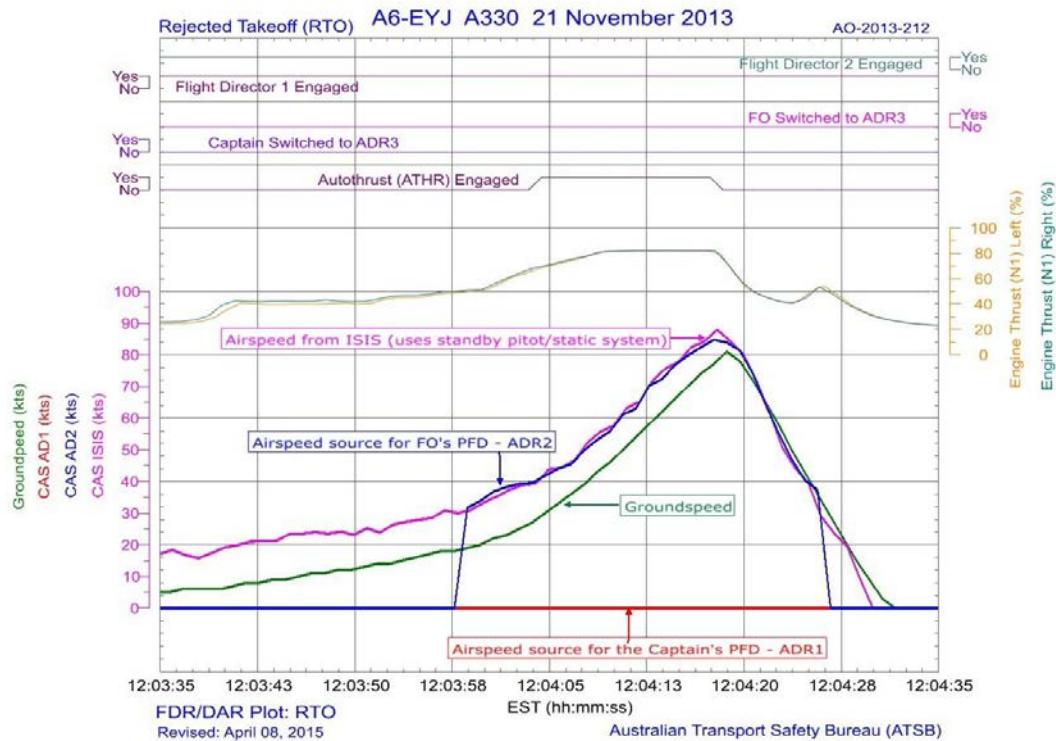
Figure 5: Location of the 'Red speed flag'



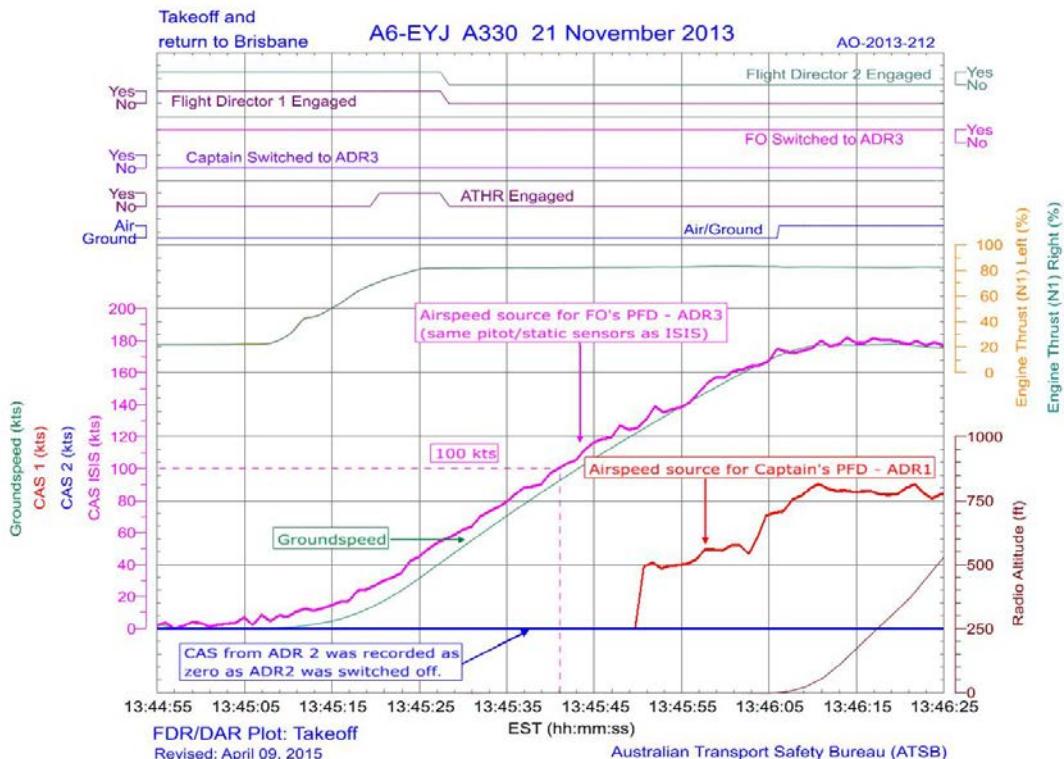
Source: Airbus (modified by ATSB)

During the second take-off at 1345, the crew reported that the airspeed flag appeared after V_1 . However, the flight data again showed that CAS sourced from ADR1 (i.e. the CAS that was displayed on the captain's PFD) was zero when ground speed increased through 50 kt (Figure 7).

¹² The airspeed data was flagged as 'no computed data' (NCD) i.e. invalid. Airspeed data is routinely flagged as NCD when it is below 30 kt. Once airspeed data increases above 30 kt, it is flagged as 'normal operating' or valid.

Figure 6: Flight data for the rejected take-off

Source: ATSB

Figure 7: Flight data for the take-off and return to Brisbane

Source: ATSB

Examination of the captain's pitot probe

The captain's probe (model 0851HL and serial number 242228) was removed from the aircraft and sent to the probe manufacturer in the USA (Figure 8). In consultation with the participants in the investigation, a test plan was developed prior to examination and testing of the probe.

Figure 8: Pitot probe



Source: UTC Aerospace Systems

The probe had been continuously fitted to A6-EYJ since its first flight and had been in service for approximately 7 ½ years. Its condition was consistent with its time-in-service with the probe inlet showing wear, but within component maintenance manual (CMM) limits. Visual inspection showed that there was no evidence of obstruction of the drain holes. A borescope examination was performed through the pitot inlet and also through the pneumatic port. The examination showed that the interior of the probe was occluded by an incomplete insect's nest and the nest material was consistent with that of the mud-dauber wasp (Figure 9). Compressed air was applied to the probe and none of the material was dislodged. The base of the nest was broken away with a sharp instrument and was fully removed by flushing with hot water. After removal of the obstruction, the probe was tested and, according to the CMM, it could be re-certified and returned to service.

Figure 9: View looking into the pitot probe inlet

Source: UTC Aerospace Systems

Other recent occurrences

B737-8FE VH-VUG 3 April 2014 Brisbane 201402626

During take-off, while accelerating through 90 kt, caution message “EEC ALT”¹³ annunciated. As engine thrust was normal, the captain continued the take-off. Once airborne, “IAS Disagree” and “ALT Disagree” messages were displayed on the crew’s PFDs and the captain’s stick-shaker¹⁴ operated intermittently. Comparison between the captain’s, FO’s and standby airspeed indications showed that the captain’s airspeed was under-reading significantly. Control of the aircraft was handed over to the FO and the aircraft levelled at 7,000 ft before returning for landing at Brisbane. Later investigation showed that the inlet of the captain’s pitot probe was partly obstructed by material consistent with a mud-dauber wasp nest.

¹³ Electronic Engine Control (EEC) has reverted to alternate (ALT) mode.

¹⁴ A tactile warning system designed to alert flight crew when the aircraft is at or near aerodynamic stall.

Safety analysis

Introduction

This analysis will consider the factors with the potential to have contributed to the aircraft becoming airborne with only a single valid source of airspeed data.

Mud-dauber wasp activity at Brisbane Airport

The captain's probe was removed from the aircraft and sent to the probe manufacturer in the US for examination. The examination showed that the interior of the probe was occluded by an incomplete insect's nest. The aircraft was on the ground at Brisbane for a period of 2 hours and 3 minutes. Despite this relatively short period, the nature of the material recovered from the captain's pitot probe makes it highly likely that the obstruction was due to mud-dauber wasp activity after the aircraft had landed.

Mud-dauber wasp activity at Brisbane Airport has been investigated previously by the ATSB¹⁵ and continuing reports and incidents indicate that it is an ongoing hazard. As the wasps cannot be completely eradicated, it is necessary to have control measures in place to minimise the chance of a pitot probe becoming obstructed. Following this incident, the Brisbane Airport Corporation (BAC) reviewed their Wildlife Hazard Management Plan (which includes wasp activity). The results of that review are detailed in the Safety Action section.

Pitot probe covers were not installed by maintenance staff during the period the aircraft was at the gate. The maintenance staff advised that the use of pitot covers was dependent on customer requirements and was not a standard practice. Operators can minimise the risk of pitot probe obstruction by consistently using pitot covers, even during short transit periods.

Maintenance action after the rejected take-off

By following the TSM procedures for an 'ADIRU1 (1FP1) BUS ADR' fault message, the aircraft maintenance engineer performed a BITE test of the EFCS 1 and 2. The units tested with normal indications and no faults were identified. The TSM procedure did not specifically identify the pitot probe as a possible cause.

Although no 'hard' (permanent) faults had been identified, the engineer, in consultation with the operator's Maintenance Control Centre, considered that the best resolution would have been to make ADR 1 inoperative. However, this was not permitted under the MEL requirements for ETOPS¹⁶ dispatch. Therefore the engineer transposed ADIRU 1 and 2 and performed a BITE test of both units. The aircraft was dispatched with the ADR part of ADIRU 2 inoperative (switched off) in accordance with the MEL. The FO's air data source was switched to ADIRU 3 and the captain's air data source remained switched to the normal (ADIRU 1) position. As a result, the blocked captain's pitot probe remained undetected and the aircraft was dispatched with only one of the three airspeed sources able to provide valid data.

Airspeed monitoring during take-off

The SOPs require the PM to scan airspeed throughout the take-off and for the PF to cross-check airspeed at 100 kt. A red flag is displayed on the captain's PFD when no valid airspeed data was available from ADR 1 at the same time as ground speed data was valid and greater than 50 kt.

The crew reported that during the RTO, a red airspeed flag was displayed on the captain's PFD. This is consistent with the flight data, which showed that the captain's CAS remained fixed at zero.

¹⁵ ATSB Report 200601453 RTO Brisbane VH-QPB 19 March 2006.

¹⁶ Defined by ICAO as Extended-range Twin-engine Operations.

During the RTO the maximum recorded CAS was 88 kt, so the take-off was able to be rejected below V1 (151 kt).

During the second take-off roll, the crew reported that the red airspeed flag was not apparent until after V1. However, the recorded flight data again indicated that it was likely that a red airspeed flag would have been displayed on the captain's PFD, after the groundspeed had reached 50 kt.

As a result, the aircraft became airborne with only a single valid source of airspeed information, with consequential serious degradation of other aircraft systems.

Findings

From the available evidence, the following findings are made with respect to the air data system failure involving an Airbus A330 aircraft, registered A6-EYJ, that occurred near Brisbane Airport, Queensland on 21 November 2013. These findings should not be read as apportioning blame or liability to any particular organisation or individual.

Safety issues, or system problems, are highlighted in bold to emphasise their importance.

A safety issue is an event or condition that increases safety risk and (a) can reasonably be regarded as having the potential to adversely affect the safety of future operations, and (b) is a characteristic of an organisation or a system, rather than a characteristic of a specific individual, or characteristic of an operating environment at a specific point in time.

Contributing factors

- Pitot probe covers were not installed by maintenance staff during the period that the aircraft was at the gate.
- The captain's pitot probe was almost totally obstructed by an insect nest, consistent with mud-wasp residue, during the 2 hour and 3 minute period while the aircraft was in transit on the ground at Brisbane.
- **The blocked captain's pitot probe was not detected by engineering staff after the initial rejected take-off. The relevant tasks in the trouble shooting manual did not specifically identify the pitot probe as a potential source of airspeed indication failure. [Safety issue]**
- During the second take-off roll, the faulty airspeed indication (displayed on the captain's PFD) was not detected and acted upon by the crew before V1 and the take-off was continued.

Safety issues and actions

The safety issues identified during this investigation are listed in the Findings and Safety issues and actions sections of this report. The Australian Transport Safety Bureau (ATSB) expects that all safety issues identified by the investigation should be addressed by the relevant organisation(s). In addressing those issues, the ATSB prefers to encourage relevant organisation(s) to proactively initiate safety action, rather than to issue formal safety recommendations or safety advisory notices.

Depending on the level of risk of the safety issue, the extent of corrective action taken by the relevant organisation, or the desirability of directing a broad safety message to the aviation industry, the ATSB may issue safety recommendations or safety advisory notices as part of the final report.

Identification of pitot probe in the trouble shooting manual

Number:	AO-2013-212-SI-01
Issue owner:	Airbus
Operation affected:	Aviation - Air transport – Large aeroplanes
Who it affects:	Maintenance engineers

Safety issue description:

The relevant tasks in the trouble shooting manual did not specifically identify the pitot probe as a potential source of airspeed indication failure.

Response to safety issue and/or Proactive safety action taken by Airbus

Action number: AO-2013-212-NSA-01

Airbus modified the A330/A340 trouble shooting manual (TSM) at the OCT 01/14 Revision to introduce the following improvements:

- The maintenance message "ADIRU1 (1FP1) BUS ADR" (class 1 or class 2) is now associated with the cockpit effect "NAV - ADIRS - Red SPD flag shown on CAPT PFD" to trigger the TSM task procedure 34-10-00-810-995-A. The same association has been made for the maintenance message "ADIRU2 (1FP2) BUS ADR" (class 1 or class 2) and the cockpit effect "NAV - ADIRS - Red SPD flag shown on F/O PFD"
- The TSM task 34-10-00-810-995-A (Altitude or Airspeed Loss and/or Discrepancy between CAPT PFD - F/O PFD - STDBY/ISIS) now refers to the pitot probes as a possible root cause.

ATSB comment

The ATSB notes the changes made by Airbus to the TSM and considers that the issue is adequately addressed.

Current status of the safety issue

Issue status: Adequately addressed

Justification: The actions taken significantly reduce the risk of pitot probe related problems remaining undetected during investigation of airspeed loss or discrepancy events.

Additional safety action

Whether or not the ATSB identifies safety issues in the course of an investigation, relevant organisations may proactively initiate safety action in order to reduce their safety risk. The ATSB was advised of the following proactive safety action in response to this occurrence:

Brisbane Airport Corporation (BAC)

Once it had been determined that the pitot probe had been blocked due to insect activity, the BAC undertook the following actions:

- Implemented a weekly inspection and eradication program for the International Terminal Building (ITB) to replace the monthly inspections which had been undertaken since 2006;
- Implemented a weekly inspection and eradication program for the Common User – Domestic Terminal Building (DTB) and Terminal Services Building (TSB);
- Engaged an entomologist to provide BAC and stakeholders with a better understanding of wasp activity, habits and behaviour;
- Issued a NOTAM to communicate wasp activity;
- Issued external stakeholder communication including to the following forums (Wasp specific meeting, Airside Safety Committee, Wildlife Working Group, Local Runway Safety Team);
- Supplied wasp nests and wasps to the Australian Museum for DNA and stomach content analysis;
- Extended the pest management program to include removal of spider webs (spiders are a food source for wasps);
- Acquired pitot probes from Qantas and Virgin Australia to undertake research as to what aircraft type pitot tube is likely to be at a greater risk; and
- Identified amendments to be made to the BAC Wildlife Hazard Management Plan (WHMP) which include wasp activity.

Etihad

Following this incident, the operator reviewed their policy on the use of protective covers and included a specific requirement for Brisbane: pitot probe covers and total air temperature covers should be used at Brisbane, irrespective of the ground time.

Civil Aviation Safety Authority (CASA)

CASA has drawn attention to the safety implications of mud wasp activity through the following publications:

- Airworthiness Bulletin 02-052 dated 6 May 2015 'Wasp Nest Infestation – Alert'
(now updated to Issue 2 dated 23 March 2016)
- The CASA Briefing for May 2015 'Be alert and alarmed about wasps'
- Flight Safety Australia feature article of 27 July 2015 'Small but dangerous ...'

These documents are available on the CASA website: <https://www.casa.gov.au>

General details

Occurrence details

Date and time:	21 November 2013 – 1345 EST	
Occurrence category:	Serious Incident	
Primary occurrence type:	Technical – Systems – Avionics / Flight Instruments	
Location:	Brisbane Airport, Queensland	
	Latitude: 27° 23.08' S	Longitude: 153° 07.73' E

Aircraft details

Manufacturer and model:	Airbus A330-243	
Year of manufacture:	2006	
Registration:	A6-EYJ	
Operator:	Etihad Airways	
Serial number:	0737	
Total Time In Service	36,021	
Type of operation:	Air transport – high capacity	
Persons on board:	Crew – 11	Passengers – 164
Injuries:	Crew – 0	Passengers – 0
Damage:	None	

Sources and submissions

Sources of information

The sources of information during the investigation included the:

- crew of A6-EYJ
- the aircraft maintenance provider
- the aircraft's flight recorders
- Airservices Australia
- Bureau of Meteorology
- UTC Aerospace Systems
- Brisbane Airport Corporation
- Airbus
- Etihad Airways.

References

Australian Transport Safety Bureau, 2008, *Rejected takeoff, Brisbane Airport, Qld, 19 March 2006* VH-QPB Airbus A330-303, Transport Safety Occurrence Report 200601453.

Submissions

Under Part 4, Division 2 (Investigation Reports), Section 26 of the *Transport Safety Investigation Act 2003* (the Act), the Australian Transport Safety Bureau (ATSB) may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. Section 26 (1) (a) of the Act allows a person receiving a draft report to make submissions to the ATSB about the draft report.

A draft of this report was provided to Etihad Airways, Airbus, pitot probe manufacturer, flight crew, Brisbane Airport Corporation and the Civil Aviation Safety Authority for comment.

Submissions received from those parties were reviewed and where considered appropriate, the text of the report was amended accordingly.

Australian Transport Safety Bureau

The Australian Transport Safety Bureau (ATSB) is an independent Commonwealth Government statutory agency. The ATSB is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers. The ATSB's function is to improve safety and public confidence in the aviation, marine and rail modes of transport through excellence in: independent investigation of transport accidents and other safety occurrences; safety data recording, analysis and research; fostering safety awareness, knowledge and action.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to operations involving the travelling public.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and Regulations and, where applicable, relevant international agreements.

Purpose of safety investigations

The object of a safety investigation is to identify and reduce safety-related risk. ATSB investigations determine and communicate the factors related to the transport safety matter being investigated.

It is not a function of the ATSB to apportion blame or determine liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

Developing safety action

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. The ATSB prefers to encourage the relevant organisation(s) to initiate proactive safety action that addresses safety issues. Nevertheless, the ATSB may use its power to make a formal safety recommendation either during or at the end of an investigation, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation.

When safety recommendations are issued, they focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on a preferred method of corrective action. As with equivalent overseas organisations, the ATSB has no power to enforce the implementation of its recommendations. It is a matter for the body to which an ATSB recommendation is directed to assess the costs and benefits of any particular means of addressing a safety issue.

When the ATSB issues a safety recommendation to a person, organisation or agency, they must provide a written response within 90 days. That response must indicate whether they accept the recommendation, any reasons for not accepting part or all of the recommendation, and details of any proposed safety action to give effect to the recommendation.

The ATSB can also issue safety advisory notices suggesting that an organisation or an industry sector consider a safety issue and take action where it believes it appropriate. There is no requirement for a formal response to an advisory notice, although the ATSB will publish any response it receives.

Investigation

ATSB Transport Safety Report

Aviation Occurrence Investigation

Air data system failure involving Airbus A330-243 A6-EYJ
near Brisbane Airport, Queensland, 21 November 2013

AO-2013-212
Final – 6 May 2016

Australian Transport Safety Bureau

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