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**Australian Transport Safety Bureau**

# In-flight smoke in the cockpit involving GIE Avions de Transport Regional ATR72, VH-VPJ

near Williamtown Airport, New South Wales, 22 February 2017

**ATSB Transport Safety Report**  
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#### **Addendum**

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# In-flight smoke in the cockpit involving GIE Avions de Transport Regional ATR72, VH-VPJ

## What happened

On 22 February 2017, at 1433 Eastern Daylight-saving Time (EDT), a Virgin Australia ATR 72-212A aircraft, registered VH-VPJ, departed Port Macquarie Airport, New South Wales (NSW) to operate scheduled flight VA1188 to Sydney, NSW. There were four crew and 23 passengers on board.

At 1453:35, during cruise at Flight Level (FL) 180,<sup>1</sup> the Centralized Crew Alerting System (CCAS) alerted the flight crew to a failure of the number one static inverter (Figure 1).<sup>2</sup> The CCAS then displayed multiple messages indicating a loss of power to systems associated with the number one static inverter. The aircraft electrical system power transfer function automatically transferred these systems to the number two static inverter and the CCAS warnings extinguished.

At 1453:43, the cockpit master warning activated and the CCAS displayed an electrical smoke warning. The flight crew immediately donned their oxygen masks and enacted the smoke checklist memory items. As the flight crew fitted the oxygen masks, they detected a strong electrical type burning odour and observed faint wispy smoke within the cockpit. After conducting the memory items, the flight crew then completed the electrical smoke checklist. The checklist included selecting the avionics vent exhaust mode to overboard. After completing this selection, the flight crew reported the smoke quickly dissipated. Flight data shows the electrical smoke warning extinguished at 1454:56.

After completing the electrical smoke checklist, the captain identified Williamtown Airport about 65 km (35 NM) south east of the aircraft and elected to divert the flight to Williamtown.

At 1455, the captain contacted air traffic control (ATC) and declared a MAYDAY.<sup>3</sup> The captain advised that they intended to divert to Williamtown Airport. ATC cleared the flight to descend and track directly to Williamtown.

After contacting ATC, the captain requested that the senior cabin crew (SCC) report to the aircraft interphone using the cabin public announcement system. The SCC heard the announcement, but due to muffling caused by the captain's oxygen mask, they did not understand the request. The second cabin crewmember heard the announcement more clearly and communicated the request to the SCC. The SCC contacted the flight deck using the aircraft interphone. The captain advised them of the emergency and that the flight was diverting to Williamtown. The SCC advised the other cabin crewmember of the diversion and commenced securing the cabin.

After securing the cabin, the SCC returned to their seat and contacted the flight deck. The captain provided them with a full briefing, advising the nature of the emergency and to expect a precautionary disembarkation<sup>4</sup> after landing. Recognising the high workload of the flight crew, the

<sup>1</sup> Flight level: at altitudes above 10,000 ft in Australia, an aircraft's height above mean sea level is referred to as a flight level (FL). FL 180 equates to 18,000 ft.

<sup>2</sup> Static inverter: a component of the aircraft electrical system which changes direct electric current to alternating current.

<sup>3</sup> MAYDAY: an internationally recognised radio call announcing a distress condition where an aircraft or its occupants are being threatened by serious and/or imminent danger and the flight crew require immediate assistance.

<sup>4</sup> Precautionary disembarkation: a disembarkation of the aircraft using the normal aircraft exits in as timely a manner as possible. Passengers are briefed to clear exit paths, leave belongings on the aircraft and that the precautionary disembarkation may become an evacuation at any time. Passengers in emergency exit rows are briefed on their actions during the precautionary disembarkation and possible evacuation.

SCC advised the captain that they would conduct the passenger briefing tasks on behalf of the flight crew. The captain instructed the SCC to begin the precautionary evacuation once the seat belt sign extinguished after landing.

As the aircraft descended through 10,000 ft, the flight crew removed their oxygen masks. The captain found the remaining odour very strong and elected to refit the oxygen mask. The captain identified that the aircraft was too high to commence an approach to Williamtown and conducted a descending orbit to lose height prior to commencing a visual approach for runway 12. While approaching runway 12, the captain found the oxygen mask blurred their vision. The captain briefly handed control of the aircraft to the first officer and removed the oxygen mask.

At 1512, the aircraft landed on runway 12. After landing, ATC instructed the flight crew to taxi the aircraft to Bay 11. Once the aircraft stopped and the flight crew shut the engines down and extinguished the seat belt sign, the SCC initiated the precautionary disembarkation. The SCC used the cabin public address system to direct passengers to disembark the aircraft using the cabin door. Emergency services personnel met the disembarking passengers and guided them clear of the aircraft to a safe area.

After shutting down the engines, the flight crew noticed the smell intensifying. The captain elected to immediately vacate the flight deck. The flight crew followed the last passenger and the cabin crew in vacating the aircraft through the cabin door.

The aircraft was not damaged and no persons were injured during the incident.

**Figure 1: Number one static inverter**



Source: Operator

***Captain comments***

The captain provided the following comments:

- Time was lost due to difficulties with the first officer refitting their headset after donning the oxygen mask. The oxygen mask also created difficulties in communication between the flight crew and cabin crew. Managing these communication difficulties added to the flight crew workload during the emergency.
- While the company did not operate the ATR 72 to Williamtown and the captain had not previously operated there, the captain commented that the best place for an aircraft with smoke in the cockpit is on the ground. The long runway, available emergency services and clear weather between their position and the airport enabled the captain to quickly elect to divert to Williamtown.

### **Senior cabin crew member comments**

The senior cabin crew (SCC) provided the following comments:

- They had not expected and were not prepared for the communications difficulties caused by the flight crew's use of oxygen masks. Their voices were heavily distorted which led to difficulty in understanding information. After the initial briefing from the captain, the SCC did not realise there was a smoke issue and believed the aircraft was experiencing an unspecified 'leak'. After the initial briefing, they began to prepare the cabin for a possible depressurisation.
- Due to the communications difficulties caused by the flight crew oxygen masks, the SCC did not realise that they were being requested to contact the flight crew and did not immediately respond.
- The aircraft interphone does not allow the flight deck to address all cabin crew at the same time. Therefore, the SCC was required to relay information to the other cabin crewmember. This made it difficult for the other cabin crewmembers to be fully aware of the progress of the incident and increased the SCC's workload.
- Cabin preparation procedures for the precautionary disembarkation require that the SCC use designated Cabin Preparation cards. These cards provide guidance for full and reduced cabin preparation procedures and associated passenger briefings. The cards were located under the SCC's seat and were inaccessible while seated. As the SCC was unable to leave their seat during the period between receiving the full briefing from the captain and landing, they were unable to access these cards.

### **Engineering examination**

The manufacturer of the static inverter conducted an engineering investigation of the failed static inverter. The investigation found that the failure of the number one static inverter and associated smoke and odour was caused by a failure of the C603 capacitor within the number one static inverter.

The aircraft manufacturer also noted that the operator experienced two previous static inverter failures in November and December 2016. These failures were caused by failure of a C311 capacitor.

### **Vendor Service Bulletin**

On 22 June 2016, the manufacturer of the static inverter released vendor service bulletin [SB 1-002-0102-2173-24-36](#).

This service bulletin identified an issue with capacitor C311 which led to instances of reduced reliability and premature failure, sometimes with associated smoke emission. As part of this service bulletin, the C311 capacitor is replaced with a modified capacitor of increased reliability.

The service bulletin recommended that the modification be incorporated at the next shop visit for the static inverter units. After completion of the service bulletin modifications the static inverters are designated as 'Amendment E' status.

From October 2016, a retrofit campaign was undertaken by the static inverter manufacturer to refit all in-service static inverters to 'Amendment E' standard.

In December 2016, the aircraft manufacturer advised operators of the vendor service bulletin. The bulletin was classified as a minor change and did not imply safety concerns.

### **Continued static inverter issues**

Following reports of failures of 'Amendment E' static inverters, the aircraft manufacturer identified an issue with additional capacitors within the static inverter. These capacitors are of the C60x (C601 through C605) series. Failures of these capacitors also led to failure of the static inverter unit and associated smoke emission.

### **Static inverter failure**

In the event of failure of a static inverter, the power transfer function automatically transfers power of the associated electrical systems to the second static inverter.

The operator's Minimum Equipment List allows dispatch of an aircraft with an unserviceable static inverter for a period of up to two days.

### **Safety analysis**

The C603 capacitor within the number one static inverter failed in a manner consistent with other C60x series capacitor failures. Failure of the capacitor resulted in failure of the static inverter and smoke being emitted into the cockpit.

Difficulties in communication with the flight deck led the SCC to initially believe the flight crew were managing an unspecified 'leak'. Therefore, the SCC began preparing for a possible depressurisation. However, as the required actions were similar to those required for the smoke event in progress, the misunderstanding did not impact on the management of the cabin during the incident.

The Cabin Preparation cards were inaccessible during the period that procedures directed the SCC to use them. However, as the SCC was able to complete the required actions without reference to the cards this did not impact on their ability to prepare the cabin for landing and the precautionary disembarkation.

### **Findings**

These findings should not be read as apportioning blame or liability to any particular organisation or individual.

- The C603 capacitor within the number one static inverter failed leading to failure of the static inverter and associated smoke.
- Difficulties in communication caused by oxygen mask use led to misunderstandings between the flight crew and cabin crew and increased flight crew workload.
- The Cabin Preparation cards were inaccessible to a seated cabin crewmember.

### **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 has been advised of the following proactive safety action in response to this occurrence.

#### **Operator**

As a result of this occurrence, the aircraft operator has advised the ATSB that they are taking the following safety actions:

- Verifying the integrity of the Power Transfer function across the ATR fleet. The operator advised that after completing this campaign no adverse findings were reported.
- The operator has initiated a retrofit campaign to route all in-service static inverters to the vendor to have the modification to both the C311A and the C60x capacitors completed ('Amendment E' and 'Amendment F' (see *Aircraft manufacturer*) standard).
- The operator has initiated a fleet wide inspection and operational test of the oxygen mask integrated microphone.
- The operator has undertaken a risk assessment for single and dual static inverter failure.

### **Aircraft manufacturer**

As a result of this occurrence, the aircraft manufacturer has advised the ATSB that they are taking the following safety actions:

Short term actions:

- Replacement of C311 capacitor resulting in service units being modified to Amendment E standard. New production units have been modified and the retrofit process is on-going.
- Change in the manufacturing process with 'burn in' test on C60x capacitors resulting in units being modified to 'Amendment F' standard. New production units have been modified. The retrofit process is being prepared.

Mid-term actions:

- A design change is under development including the replacement of the C60x capacitors. The redesigned unit will be identified with a new part number. The design change certification expected to be complete before the end of quarter 2, 2017.

### **Safety message**

This incident underlines the value of effective training and procedures. Despite the communications difficulties and the inaccessible cabin preparation cards, the cabin crew were able to effectively prepare the cabin during the diversion and manage the subsequent precautionary disembarkation. This enabled all aircraft occupants to disembark the aircraft quickly and without injury.

### **General details**

#### **Occurrence details**

Date and time:	22 February 2017 – 1456 ESuT	
Occurrence category:	Incident	
Primary occurrence type:	Smoke	
Location:	77 km NW of Williamtown Airport, NSW	
	Latitude: 32° 09.40' S	Longitude: 151° 30.03' E

#### **Aircraft details**

Manufacturer and model:	ATR - Gie Avions De Transport Regional ATR 72-212A	
Registration:	VH-VPJ	
Operator:	Virgin Australia	
Serial number:	1169	
Type of operation:	Air Transport High Capacity - Passenger	
Persons on board:	Crew – 4	Passengers – 23
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	Nil	

### **About the ATSB**

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; and 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.

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

## About this report

Decisions regarding whether to conduct an investigation, and the scope of an investigation, are based on many factors, including the level of safety benefit likely to be obtained from an investigation. For this occurrence, a limited-scope, fact-gathering investigation was conducted in order to produce a short summary report, and allow for greater industry awareness of potential safety issues and possible safety actions.