SERIOUS INCIDENT

Aircraft Type and Registration:	ATR 72-212 A, G-CMFI
No & Type of Engines:	2 Pratt & Whitney Canada PW127M turboprop engines
Year of Manufacture:	2016 (Serial no: 1312)
Date & Time (UTC):	9 October 2022 at 1850 hrs
Location:	Leeds Bradford Airport
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 4 Passengers - 41
Injuries:	Crew - None Passengers - None
Nature of Damage:	No damage
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	31 years
Commander's Flying Experience:	5,134 hours (of which 2,456 were on type) Last 90 days - 243 hours Last 28 days - 74 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

After landing, the crew smelled smoke on the flight deck. The aircraft was brought to a stop on the runway and the commander ordered a rapid disembarkation. The operator identified the source of the smell as a static inverter failure. The cause of the smoke emission was known by the aircraft manufacturer and its supplier. A corrective Vendor Service Bulletin had been developed and distributed to operators, but the operator was unaware of the issue.

The operator has updated maintenance and operational procedures in response to the event.

History of the flight

The flight was a charter from Biggin Hill to Leeds Bradford Airport. There were four crew members and 41 passengers on board. The flight was uneventful and the aircraft landed after flying a normal ILS approach to Runway 14. Whilst decelerating below 70 kt, the master caution sounded with an ELEC inverter (INV) 1 fault, followed by a master warning for ELEC smoke.

The co-pilot commented that he could smell smoke and the commander agreed. The aircraft was brought to a stop on the runway and the parking brake set. ATC were informed of the possibility of smoke being present on the flight deck and the crew requested the fire service to attend the aircraft.

The commander called the senior cabin crew member (senior) via the interphone and asked if he could smell smoke in the cabin, to which the senior cabin crew replied “no”. The commander told the senior that the pilots could smell smoke on the flight deck. The senior left his seat at the back of the aircraft and walked through the cabin, after which he reported smelling smoke. There was no visible smoke on the flight deck or in the passenger cabin. The commander told the senior to wait for further instructions.

The commander then spoke on 121.6 MHz directly to the fire commander, who confirmed there was no visible external smoke and no hotspots were detected on the aircraft. The copilot commented that the smell of smoke was beginning to dissipate.

The crew discussed their options and the commander elected to initiate a rapid disembarkation on the runway, as he was not content to continue to taxi to the parking stand but wanted to avoid any panic which could be introduced by an evacuation. Both propellers were feathered and the propeller brake engaged, and the left engine was shutdown. The senior was informed of the decision to rapidly disembark the aircraft by a QNITS[1] brief via the interphone. The commander did not make a PA instructing the passengers to leave the aircraft and the evacuation checklist was not followed. The commander decided to keep the right engine running in ‘Hotel mode’ (see description below) to power the cabin lights as it was dark outside.

The passengers and cabin crew disembarked onto the runway and were subsequently transported to the airport. The pilots decided to remain on board to facilitate towing from the runway to a stand. There were no reported injuries.

Aircraft information

Electrical system

G-CMFI is an ATR 72-212 twin turboprop aircraft manufactured in 2016.

The ATR electrical system comprises two batteries (main and emergency), two engine-driven DC starter/generators, two AC wild frequency generators and two external power units. There are two static inverters (INV), supplied by the DC system, which provide constant frequency AC power (Figure 1).

INV 1 normally supplies AC BUS 1 and AC STBY BUS, while INV 2 normally supplies AC BUS 2. In the event of inverter failure or input power loss, the associated AC BUS is isolated from the affected inverter and AC BUS 1 and 2 are automatically connected by the Bus Tie Relay (BTR). In the event of INV 1 failure or input power loss, AC STBY BUS is automatically supplied from INV 2. An INV FAULT light will illuminate amber on the overhead panel in the event of an inverter failure or loss power supply.

Footnote

[1] QNITS brief format: Questions, Nature of emergency or abnormal situation, Intention, Time, Special instructions.

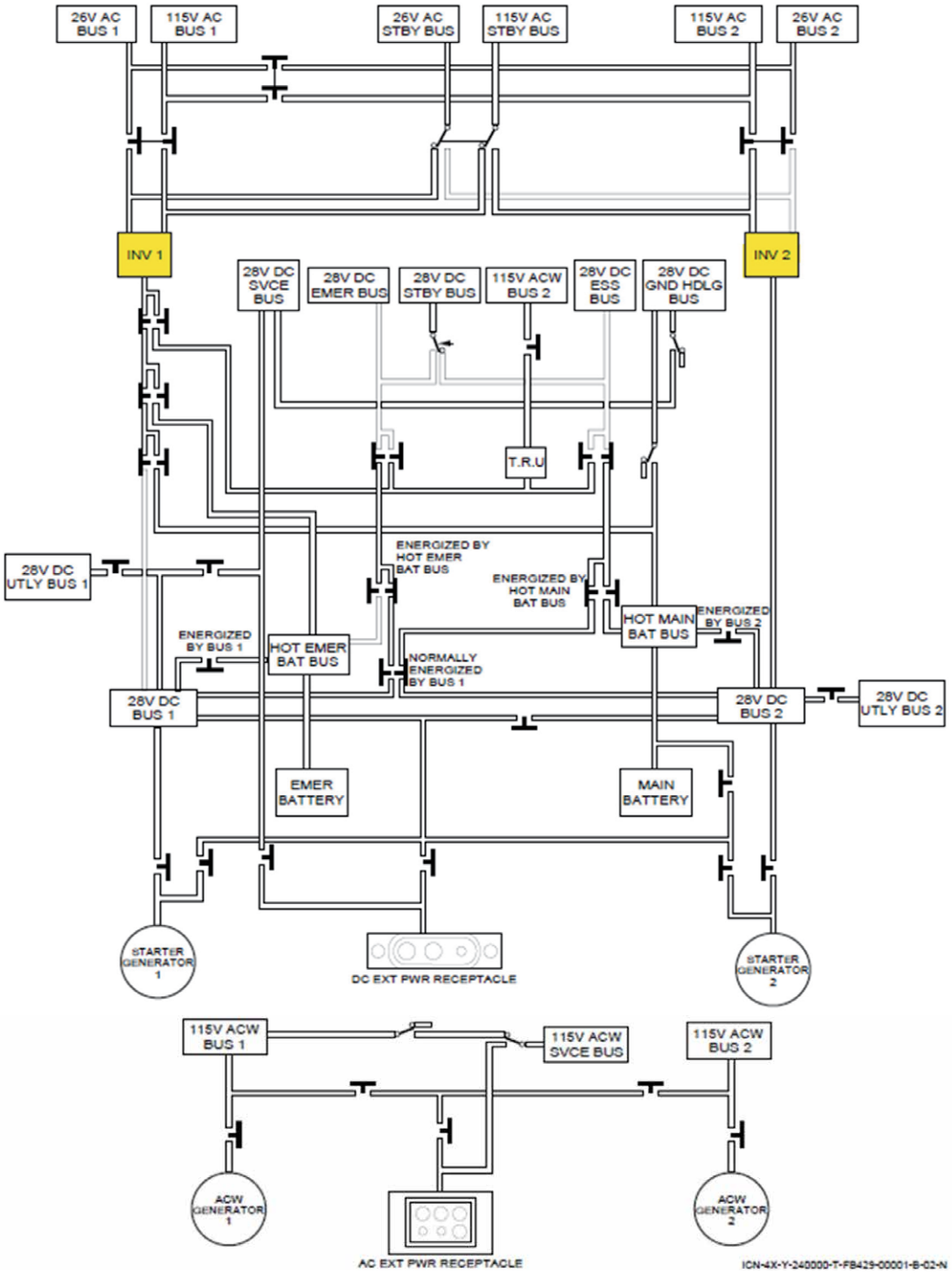

Figure 1

ATR 72-212 Electrical system

Hotel mode

In Hotel mode the propeller is held stationary by a hydraulically operated brake, allowing the right engine to operate as an auxiliary power unit. There are hazards associated with this operation such as noise and hot gases, and its use prohibited in tailwind speeds greater than 10 kt.

The flight crew operating manual gives the following operational procedures and limitations regarding right engine operation in hotel mode:

- 'Hotel mode may not be used when the aft service door is open.
- *Hotel mode may not be used when refuelling the aircraft.*
- *The tailwind component should not exceed 10kts except for transitory conditions.*
- *One flight crew member must remain in the flight deck at all times whilst Hotel mode is in use.*
- *Cabin crew [if on board] shall be informed when Hotel mode is in use, except during routine full engine start and shutdown.*
- *De-icing with Hotel Mode may only be accomplished when de-icing is to be conducted remotely and only after briefing the de-icing team.*
- *Both pilots must be aware that Hotel mode is in operation.*
- *The wing light must be turned on before the engine is started in Hotel Mode and must be turned off when the engine is shut down.'*

Source of fumes

The operator found the source of the fumes to be the static inverter number 1. It had recorded 6,617.22 flight hours in service, while the guaranteed mean time between unexpected removal (GMTBUR) is 15,000 flight hours.

Vendor Service bulletin

Following a consultation between the operator and manufacturer after this event, the manufacturer identified a Technical Progress Status (TPS) report which it highlighted that inverter 1-002-0102-2173 was known to have had several events of a similar nature[2], although the operator was not aware of this.

The report referred to Inverter Vendor Service Bulletin (VSB)[3], which identified that specific serial numbers of static inverters were affected by high failure rates and should be modified through replacement of capacitors. Both static inverters on G-CMFI were affected by this VSB. The VSB was transmitted by ATR in AOM 2017-08 and TPS 24-21-001. There was no associated airworthiness directive (AD).[4]

The manufacturer identified 42 previous events of smoke, or a smell of smoke where the cause was identified as the failure of a static inverter.

Footnote

[2] ATR Technical Progress Status report (24-21-001).
[3] Vendor Safety Bulletin 1-002-0102-2173- 24-41.
[4] ATR 72-212 Airworthiness Operator Message 42/72/2017/08 issue 1.

In response to the event, the operator replaced INV 2 on G-CMFI with an inverter with a serial number not affected by the VSB. A bulletin was circulated within the maintenance department informing of a change to treat the manufacturer AOM's in the same way as a SB, to avoid a similar oversight of known issues in the future. A review of manufacturer AOM's was also carried out to ensure no other relevant messages were missed by the operator. None was identified.

Meteorology

The weather reported at Leeds Bradford Airport included clear skies and a light wind of approximately 8 kt from the south-east, and the temperature was 13°C.

Aerodrome information

Leeds Bradford Airport has one concrete runway 14/32 which is 2,250 m long. The landing distance available for Runway 14 is 1,801 m.

Personnel

Both crew members held valid licences and their medicals were in date.

Organisational information

Emergency procedures

Evacuation

Section 11 in the Operations Manual Part B (OMB) for the ATR 72 provides emergency evacuation procedures. It describes two types of evacuations as follows.

- *'The planned evacuation will usually be the result of an airborne event, and possible evacuation requirements will have been discussed with the crew via a QNITS brief. Examples of such planned evacuations may be perhaps after a gear unsafe warning in the air, or a fire.*

- *The unplanned evacuation will result from an unforeseen event, the crew not having had time to plan and discuss a strategy to deal with the situation.'*

Examples of unplanned evacuations include smoke in the cabin after landing, but the guidance document states *'Procedures are set out as a general guide, and at the* [commanders] *discretion, may be revised. For example, does the situation still require an evacuation, or would a rapid disembarkation be more prudent?'*

The *'Emergency evacuation checklist'* (Figure 2) and procedures in the Operations Manual Part B should be followed for any evacuation, but these are not memory items.

EMERGENCY EVACUATION (ON GROUND)

- AIRCRAFT ..... STOP
- BRAKE HANDLE ..... PARKING
- ATC (VHF1) ..... NOTIFY
- AUTO PRESS DUMP ..... ON
- MIN CAB LT ..... ON
- CABIN CREW (PA) ..... NOTIFY
- CL 1+2 ..... FTR THEN FUEL S.O.
- FIRE HANDLES 1+2 ..... PULL
- AGENTS ..... DISCH AS RQRD
- ENG START selector ..... OFF & START ABORT
- FUEL PUMPS 1+2 ..... OFF
- EMER EXIT LT ..... ON
- EVACUATION (PA) ..... INITIATE

• **Before leaving aircraft**

- BAT ..... OFF

Figure 2

QRH '*Emergency evacuation (on ground)*' Checklist

Post-evacuation guidance in OMB states that the commander must take charge and provide any relevant information to the rescue team. The crew should direct passengers to a secure and protected area upwind away from the aircraft, keeping passengers grouped together. It further states that '*passengers will rely on leadership'*.

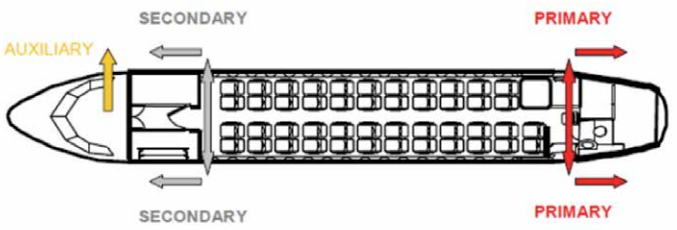

Figure 3

Recommended exit routes on land

During an evacuation, all five emergency exits should be used (Figure 3).

Precautionary rapid disembarkation

Operations Part B for the ATR 72 describes a rapid disembarkation as:

> *'A situation may arise where there is a need to disembark the aircraft promptly using normal exits only, e.g. during passenger boarding, push/power back or prior to arrival… Although serious, the situation may not warrant a full evacuation but crews must remain vigilant in the event that the situation may turn into a full emergency...* [the commander] *should then inform passengers of the situation via the PA.'*

There was no procedure for crew to follow when initiating a rapid disembarkation with engines running.

The operator issued the flight crew instruction (FCI) '*Evacuate or Deplane*' in 2018, which was intended to prepare pilots to consider the most appropriate response following an emergency.

The operator stated that the main difference between an evacuation and rapid disembarkation is that the emergency exits are not used in a rapid disembarkation. The forward exits and aft exit on the right side differ from the aft left exit (which is used to board and disembark the aircraft during normal operations) as they have no access steps. The operator considered there was an increased risk of injuries to passengers in using these emergency exits.

Updated operator guidance

In response to this event, the operator indicated it intends to update its procedures and guidance to flight and cabin crew regarding rapid disembarkations, to provide greater clarity on the distinction between an evacuation and a precautionary rapid disembarkation, and the appropriate application of both procedures. It proposed the following:

- Emergency Rapid Disembarkation checklist
- Evacuation/ Rapid disembarkation training material for CRM and refresher training
- Flight Crew Instruction – Rapid Disembarkation
- Cabin Crew Instruction – Precautionary Rapid Disembarkation

These are in draft form and are intended to be published in line with the operator's normal publication processes.

Analysis

Source of fumes

The static inverter failure mode involved in this occurrence was identified by ATR and its supplier in 2017. The topic was communicated to the operator through a TPS report, VSB, and an AOM. These do not require mandatory operator action and the topic was addressed through an AD. The operator was not aware of the incidence of failures. The new procedure introduced by the operator, requiring AOM's to be read and assessed for relevance to their fleet, is intended to avoid information of this nature being overlooked in future.

Rapid disembarkation

There was no procedure for rapid disembarkation with engines running, and the guidance on when it might be appropriate to do so was incomplete. The OMB suggested it may be prudent in some circumstances to implement a rapid disembarkation instead of an evacuation but did not provide detail. In the absence of a clear procedure the crew elected to keep the number 2 engine in Hotel mode, where the risks of doing so were not explicitly considered.

The cabin crew and passengers were not made aware of the operating engine on the right side of the aircraft as they disembarked. The commander did not make a PA to the passengers, as required by the guidance which was available in the Operations Manual Part B, and the risk of losing control of the passengers once they had deplaned was not considered in this context. By not disembarking themselves, the pilots were not present to manage the post-disembarkation phase of the occurrence. This may have created additional ambiguity around who held responsibility for the passenger's safety in a high-risk environment. As it was not considered an evacuation, the *'Post Evacuation'* section of OMB was not expressly applicable, although this guidance may be as relevant in this scenario as if a full evacuation had taken place.

Conclusion

The source of the fumes was confirmed to be the failure of static inverter 1. There was a Technical Progress Status report published by the manufacturer and an associated Airworthiness Operator Message indicating previous failures of static inverters which were not seen by the operator before the event. The operator introduced new procedures to ensure future AOM's will be treated as safety bulletins.

A rapid disembarkation was carried out in the absence of a specific procedure. The operator intends to introduce additional checklists and guidance for crews choosing to conduct a rapid disembarkation in future.