MINISTRY OF CONSTRUCTION AND TRANSPORT

TRANSPORTATION SAFETY BUREAU

FINAL REPORT

Aeroflot – Russian Airlines, Airbus 320-214, VP-BMF

Vicinity of Orosháza

3 February 2019

Serious Incident

2019-069-4

The sole objective of a safety investigation is to find the causes and circumstances of aviation accidents or incidents and to initiate the necessary safety measures; furthermore, to make recommendations in order to prevent similar cases in the future. It is not the objective of an investigation to apportion blame or liability.

Introduction

Synopsis

Occurrence class		Serious Incident
Aircraft	Manufacturer	AIRBUS
	Model	A320-214
	Registration	VP-BMF
	Operator	Public Joint Stock Company “Aeroflot – Russian Airlines”
Occurrence	Date and Time	03 February 2022, 19:20 LT
	Location	Vicinity of Orosháza
Fatalities / Severe Injuries		No injury
Damage to Aircraft		No damage

On 3 February 2019, on the Belgrade (LYBE) - Moscow (UUEE) route, smoke appeared in the front galley of an Airbus 320-214 aircraft (AFL2097) 5 minutes after take-off. The flight attendants were unable to identify the origin of the smoke exactly. The PIC decided to make an emergency landing at Budapest Ferenc Liszt International Airport (LHBP). There were no injuries during the incident.

The TSB’s on-site investigators found that the smoke had been caused by a malfunction of the heated floor panel at the front entry door (1L).

The IC asked the accident investigation agency (BEA) of the state of the aircraft’s manufacturer and designer to assess the heated floor panel, and then the manufacturer of the heated panel, with the assistance of the National Transportation Safety Board (NTSB). The IC identified the root cause of the incident as the corrosion of the heated floor panel in the front galley, which had caused a short circuit in the heating element.

As the aircraft manufacturer’s publications also provide guidance on how to deal with failures in addition to the final solution when using the older aluminium skin heated floor panels, the IC does not propose to issue a safety recommendation.

Figure 1: The aircraft involved in the incident (Source: https://www.planespotters.net)

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Definitions and abbreviations

1L	*Senior cabin crew member, a flight attendant on duty in the front left-hand side part of the aircraft*
1R	*A flight attendant on duty in the front right-hand side part of the aircraft*
3L	*A flight attendant member on duty in the rear left-hand side part of the aircraft*
3R	*A flight attendant on duty in the rear right-hand side part of the aircraft*
AAIB	*Air Accident Investigation Branch (UK)*
Aerodrome	*A defined area (including any buildings, installations and equipment) on land or water or on a fixed offshore or floating structure intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft*
ARP	*Aerodrome Reference Point*
BEA	*Bureau d'Enquêtes et d'Analyses (France)*
BUD AOCC	*Budapest Air Operation Control Center*
EASA	*European Union Aviation Safety Agency*
Flight plan	*Specified information provided to air traffic service units, relative to an intended flight or portion of flight of an aircraft;*
IC	*Investigating Committee*
ICAO	*International Civil Aviation Organization*
Kbvt.	*Act CLXXXIV of 2005 on the safety investigation of aviation, railway and marine accidents and incidents and other transportation occurrences*
LT	*Local Time*
MTBUR	*Mean Time Between Unscheduled Removal*
MTOM	*Maximum Take-Off Mass*
NFM	*Ministry of National Development*
NKH LH	*National Transport Authority Aviation Authority, Hungary (till 31 December 2016)*
NTSB	*National Transportation Safety Board (USA)*
SCC	*Senior Cabin Crew*
TSB	*Transportation Safety Bureau (Hungary)*
UTC	*Coordinated Universal Time*
VFR	*Visual Flight Rules*

General information

All times indicated in this report are in local time (LT). LT at the time of the occurrence: UTC+1 hour.

Geographic locations throughout this document are provided in WGS-84 standard.

The capitalised job titles used throughout this document (e.g. Captain, Pilot, etc.) refer to the particular persons concerned in the event investigated.

The format and content of this report is in harmony with Chapter 6 of Annex 13 of Act XLVI of 2007 promulgating the Appendices to the Convention on International Civil Aviation, signed in Chicago on 7 December 1944, as well as with the requirements set out in ICAO Doc 9756 Part IV.

Reports and Notifications

The occurrence was reported to the TSB's call center at 19:20 on 03 February 2019, by the on-call officer of BUD AOCC.

TSB of Hungary notified the following organisations:

- Accident Investigation Authority of the State of Operator (MAK), on 05 February 2019, at 14:57.
- Accident Investigation Authority of the State of Manufacture and Design (BEA), on 05 February 2019, at 14:59.
- Accident Investigation Authority of the State of Registry (BERMUDA), on 05 February 2019, at 15:01 and the UK investigation body (AAIB) on 05 February 2019, at 15:01.
- ICAO, on 05 February 2019, at 15:12.
- EASA, on 05 February 2019, at 15:17.
- NTSB, on 29 November 2019.

The following of the notified foreign organisations appointed an accredited representative for the investigation.

- State of Operator of the aircraft: Russian Aviation Authority
- State of Design of the aircraft: BEA
- State of the floor panel's manufacturer: NTSB

Investigation Committee

The Head of TSB appointed the following persons in the investigating committee (hereinafter: IC).

Investigator-in-Charge	Mr. Erdősi Gábor	investigator
Member	Ms. Kitti Dusnoki	investigator

Overview of the Investigation Process

Receiving event notification, the on-duty manager of the TSB ordered an immediate dispatch to the site.

Pursuant to Article 5 of REGULATION (EU) No 996/2010 of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation and repealing Directive 94/56/ECA the TSB is required to initiate an investigation in the following circumstances.

1. *Every accident or serious incident involving aircraft other than specified in Annex II to Regulation (EC) No 216/2008 of the European Parliament and of the Council of 20 February 2008 on common rules in the field of civil aviation and establishing a*

European Aviation Safety Agency (6) shall be the subject of a safety investigation in the Member State in the territory of which the accident or serious incident occurred.

2. *When an aircraft, other than specified in Annex II to Regulation (EC) No 216/2008, registered in a Member State is involved in an accident or serious incident the location of which cannot be definitely established as being in the territory of any State, a safety investigation shall be conducted by the safety investigation authority of the Member State of registration.*
3. *The extent of safety investigations referred to in paragraphs 1, 2 and 4 and the procedure to be followed in conducting such safety investigations shall be determined by the safety investigation authority, taking into account the lessons it expects to draw from such investigations for the improvement of aviation safety, including for those aircraft with a maximum take-off mass less than or equal to 2 250 kg.*
4. *Safety investigation authorities may decide to investigate incidents other than those referred to in paragraphs 1 and 2, as well as accidents or serious incidents to other types of aircraft, in accordance with the national legislation of the Member States, when they expect to draw safety lessons from them.*

Based on the findings of the site inspection and with regard to Article 5 (1) of Regulation (EU) No 996/2010 of the European Parliament and of the Council, the head of the TSB decided that an investigation was required and would be launched.

In the course of the safety investigation, the IC has taken the following steps:

- took photographs during the site inspection;
- requested the radio coverage, radar images and flight plan;
- obtained documents and reports of the flight crew;
- asked the airline involved in the incident for a report;
- sent the faulty equipment to the manufacturer of the aircraft and equipment for further investigation;
- received the results of the examination from both manufacturers;
- analysed the documents obtained and the results of the investigations and drew conclusions.

Investigation Principles

This investigation is being carried out by Transportation Safety Bureau on the basis of the following disciplines.

- Regulation (EU) No 996/2010 of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation and repealing Directive 94/56/EC,
- Act XCVII of 1995 on aviation,
- Annex 13 identified in the Appendix of Act XLVI. of 2007 on the declaration of the annexes to the Convention on International Civil Aviation signed in Chicago on 7th December 1944,
- Act CLXXXIV of 2005 on the safety investigation of aviation, railway and marine accidents and incidents (referred to as Kbvt. throughout the document),
- NFM (Ministry for National Development) Regulation 70/2015 (XII.1) on safety investigation of aviation accidents and incidents, as well as on detailed investigation for operators,
- In matters not covered by Kbvt., Act CL of 2016 on General Public Administration Procedures.

The competence of the Transportation Safety Bureau of Hungary is based on Government Regulation № 230/2016. (VII.29.) on the assignment of a transportation safety body and on the dissolution of Transportation Safety Bureau with legal succession.

Pursuant to the aforesaid legislation,

- Transportation Safety Bureau of Hungary shall investigate aviation accidents and serious incidents.
- Transportation Safety Bureau of Hungary may investigate aviation incidents which – in its judgement – could have led to accidents with more severe consequences in different circumstances.
- Transportation Safety Bureau of Hungary is independent of any person or entity that may have interests in conflict with the objectives of the investigating body.
- In addition to the aforementioned legislation, TSB of Hungary shall conduct safety investigations in line with ICAO Docs 9756 and 6920 Manual of Aircraft Accident Investigation.
- This Report shall not be binding, nor shall an appeal be lodged against it.
- The original of this report was written in Hungarian.

No conflict of interest has been identified between safety investigators appointed to the IC. No investigator assigned with a safety investigation has been involved as an expert in any other procedure pertaining to the same case and shall not do so in the future.

The IC shall retain all data and information having come to their knowledge in the course of the safety investigation. Furthermore, the IC shall not be obliged to make such data and information available to other authorities, whose disclosure could have been legally refused by their original owner.

This Final Report is based on the Draft Report prepared by the IC and shall be sent to all involved parties for comments, as set forth by the relevant regulations.

No comments on the draft report were received from the interested parties within the legal deadline.

Copyright

Translation

This document has been translated from Hungarian. Although efforts have been made to provide a translation as accurate as possible, discrepancies between the versions might occur. In such eventuality, the Hungarian version shall prevail.

1. Factual information

1.1 Flight History

The IC reconstructed the course of the incident on the basis of the report of the airline concerned, the information contained in the on-board voice recorder (CVR) and the aircraft's technical logbook.

The planned route of the Airbus 320-214 aircraft with registration VP-BMF involved in the incident was Belgrade (LYBE) to Moscow (UUEE). Based on the aircraft's technical logbook, no technical problems arose during the pre-flight inspection.

The aircraft took off from Nikola Tesla Airport (LYBE), Belgrade at 18:51, and about 5 minutes later, the flight attendants in the first galley smelled the odour of burning wires. The SCC immediately notified the flight crew the detection of burning smell, which the pilots had also smelt by then. According to procedure, the1R de-energized the electrical equipment by pulling out the circuit breakers (CB) in the front galley. Then she checked the electrical equipment in the front galley. The flight attendants in the front galley checked the surrounding areas, the lavatory (water heater, waste bin) and the front storage compartments, but the source of the burning smell was not found. The burning wire smell decreased for a while, but after a short time it got more intense again. At that time, the SCC not only smelt the odour of burnt wire but also saw grey smoke at the lower left corner of the front entry door, and she checked the heating of the floor panel. After that she also checked the temperature of the front entry door threshold, the side and floor panel connection and the adjacent side panels. Meanwhile, the smoke intensified and the flight attendants in the first galley tried to control the situation by using a fire extinguisher directed directly to the side and floor panel connection. The SCC immediately informed the flight crew of the increase in smoke and the actions taken, and also contacted the flight attendants in the rear galley. The captain then reported emergency to the air traffic control for technical reasons. According to the flight attendants in the rear, the smell of burning could be smelled in the rear galley as well as in the cabin. 3R and 3L checked the electrical equipment and the lavatories in the rear galley, but found no fire or smoke. At the request of the SCC, 3R took 2 fire extinguishers to the front galley. The captain then informed the cabin crew of the emergency landing at Budapest airport.

The cabin crew started to prepare the cabin for landing and informed the passengers about the situation to avoid possible panic.

During landing (19:08-19:22 LT), 1L and 1R monitored the environment for the appearance of smoke until the aircraft stopped and used two more fire extinguishers 5 minutes apart in order to prevent a possible fire. The aircraft landed at Budapest Liszt Ferenc International Airport (LHBP) at 19:25 safely and without any personal injury.

1.2 Injury to Persons

	Crew		Passengers	On the Aircraft	Others
	Flight Crew	Cabin Crew			
Fatal	-	-	-	-	-
Serious	-	-	-	-	-
Minor	-	-	-	-	-
Not injured	2	4	98	104	-
Summary	**2**	**4**	**98**	**104**	**-**

1.3 Aircraft Damage

The heated floor panel in the forward galley of the aircraft involved, located on the LH side of the aircraft, was damaged.

1.4 Other Damage

The IC had got no information on other damage by the completion of the investigation.

1.5 Crew Information

1.5.1 Pilot-in-Command

Age, nationality, gender		31 years old, Russian, male
Licence data	type	ATPL
	professional valid until	15/03/2019
	ratings	A320/321/IR Captain
Medical class and valid until		1 / 2 / LAPL, 15/03/2019
Flight hours / take-offs	in the preceding 24 hours	4 hours / 2 take-offs
	in the preceding 7 days	26 hours / 10 take-offs
	in the preceding 90 days	120 hours / 44 take-offs
At the time of the occurrence		Pilot Monitoring
In the preceding 48 hours		rest period: 21 hours 50 minutes duty time: 8 hours 40 minutes
Date of most recent training		17/01/2019
Results of most recent training, mandatory and periodic checks		Passed

1.5.2 Pilot Monitoring

Age, nationality, gender		30 years old, Russian, male
Licence data	type	CPL
	professional valid until	24/10/2019
	ratings	A320/321/IR
Medical class and valid until		1 / 2 / LAPL, 24/04/2019
Flight hours / take-offs	in the preceding 24 hours	4 hours / 2 take-offs
	in the preceding 7 days	26 hours / 10 take-offs
	in the preceding 90 days	162 hours / 72 take-offs
At the time of the occurrence		Pilot flying
In the preceding 48 hours		rest period: 21 hours 50 minutes duty time: 8 hours 40 minutes
Date of most recent training		04/12/2018
Results of most recent training, mandatory and periodic checks		Passed

1.5.3 Senior Cabin Crew (SCC)

Age, nationality, gender		40 years old, Russian, female
Licence data	type	Flight Attendant
	professional valid until	15/02/2020
	ratings	A320/B737/A330/B777/RRJ-95
Medical class and valid until		Type II / 20/02/2020
Flight hours / take-offs	in the preceding 24 hours	Did not fly
	in the preceding 7 days	24 hours 1 minute
	in the preceding 90 days	161 hours 55 minutes
	total:	12764 hours 18 minutes
	total on this type:	2414 hours 41 minutes

1.6 Aircraft Information

1.6.1 General Information

Class	Fixed wing aircraft (MTOM > 5700kg)
Manufacturer	AIRBUS
Model	A320-214
Year of manufacture	08/12/2008
Serial number	3711
Nationality and registration marks	VP-BMF
State of registry	Bermuda
Date of registry	11/12/2008
Owner	Skylease Bermuda Ltd.
Operator	Public Joint Stock Company „Aeroflot – Russian Airlines”
Airline	Aeroflot – Russian Airlines
Call sign	AFL2097

	Flight hours	Take-offs
Since manufacture	35791	15327
Since overhaul	N/A	N/A
Since last inspection	9.8	4

1.6.2 Airworthiness Certificate

Airworthiness Certificate	Number	1271
	Date of issue	13/11/2018
	Valid until	10/12/2019
	Restrictions	None

1.6.3 Aircraft Loading Data

The mass of the aircraft on landing did not exceed the maximum weight for landing. Aircraft load data had no influence on the course of incident, so further details are not required.

1.6.4 Malfunctioning Systems or Equipment

Designation of malfunctioned system / part	Heated floor panel
Location of installation	Front galley
Manufacturer	Collins Aerospace
Date of manufacture	2010
Item number	4E4140-1
Serial number	MCXZ300

Heated floor panels (external and/or internal) can be installed around the entry doors of aircraft. This ensures an even heat distribution around the area, reduces the effect of possible draughts and thus serves as a solution for passenger and crew comfort (*Figure 2)*.

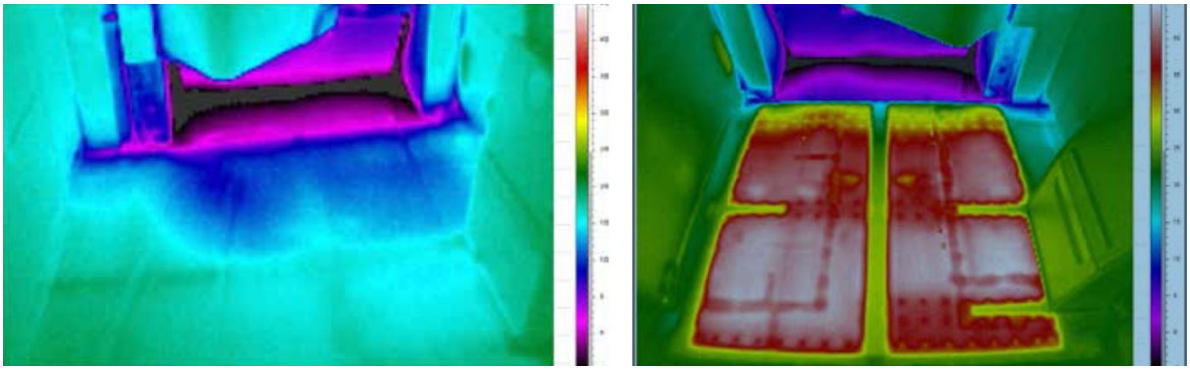

Figure 2: Thermal image of unheated entry door on the left vs. heated on the right
(Source: https://www.proponent.com/wp-content/uploads/2018/01/Collins-Heated-Floor-Panels.pdf)

The structural lay out of the heated floor panels are similar to the standard non-heated floor panels, but with an electric heating element with temperature control and overheating protection inside. The shell tiles of the floor panel concerned in this case are made of aluminium. According to information received by the IC, in several cases such aluminium skin panels have been exposed to short circuit in the heating circuit of the floor panel, due to corrosion. Both the aircraft and the floor panel manufacturer also recommends the replace of the aluminium skin heated floor panels with the newer titanium skin panels to reduce corrosion and associated electrical short circuit problems.

The defective heated (so called external) floor panel with aluminium skin at the left side entry door (1L) was installed in the aircraft on 07/11/2012. According to information available to the IC, the panel had not been repaired prior to the incident and its service life is not determined. Based on the documents, the panel had already operated for 21927 hours.

1.6.5 On-board Warning Systems

The aircraft was equipped with transponder, traffic alert and collision avoidance system (TCAS), ground proximity warning system (EGPWS).

The systems worked in compliance with the requirements, and the IC made or received no comment relating to irregularity of their operation.

1.7 Weather Information

The weather conditions did not influence the occurrence of the event, further details are not required.

1.8 Aids to Navigation

The equipment items specified in the type certificate were installed on the aircraft, and the IC made or received no comment relating to irregularity of their operation.

Navigation equipment had no influence on the course of events, so further details are not required.

1.9 Communication

The equipment items specified in the type certificate were installed on the aircraft, and the IC made or received no comment relating to irregularity of their operation.

The IC made or received no comment relating to irregularity of the operation of the ground-based equipment items which proved to be serviceable.

Communication equipment had no influence on the course of events.

1.10 Aerodrome Information

Take-off was performed from Nikola Tesla Airport, Belgrade (LYBE) at 18:51 on 03 Feb 2019.

The scheduled destination airport was Sheremetyevo International Airport (UUEE).

Actual landing was performed at Budapest Liszt Ferenc International Airport (LHBP) on 03 February 2019, at 19:25.

The aerodrome involved in the occurrence had valid operation certificate.

Name of aerodrome	Budapest Liszt Ferenc International Airport
Location indicator	LHBP
Airport operator	Budapest Airport Zrt.
Reference point (ARP)	47°26'22N 19°15'43E
Elevation	151 metres
Runway identification	13L-31R, 13R-31L
Runway length	3707x45 metres, 3010x45 metres
Runway surface	Concrete

The parameters of the airport did not affect the accident, further details are not required.

1.11 Data Recorders

The audio and data recording equipment installed on the aircraft was removed from the aircraft by the contracted maintenance organisation. After landing the on-site investigators not seize the equipment: it was taken to the airline’s headquarters for analysis. It is relevant to the case that the flight data recorder does not record data on the closed or open status of the galley circuit breaker (CB) located on the CB panel in the front galley (2000VU). As regards the cockpit voice recorder (CVR) data, the airline only sent the audio of the radio communications between the flight crew and air traffic control to the IC, which was assessable, but the operator did not send the crew-to-crew communications, despite the

request of the on-site inspection team. Some elements of the audio have been used by the IC in this Final Report.

The data recording systems required for the air traffic management equipment were serviceable and the data recorded by them was evaluable.

1.12 Wreckage and Impact Information

There was no wreckage caused by the occurrence.

The safety investigation did not reveal any information that the aircraft structure or any of its systems had failed prior to the incident, thereby contributing to or influencing the incident.

1.13 Medical and Pathological Information

There was no forensic medical examination.

There was no indication of any physiological factor or other impediments affecting the Pilot's capacity or capabilities.

1.14 Fire

There was no visible fire during or after the occurrence, but there was smell of burning wires and then grey smoke could be seen at the floor panel of the aircraft's front entry door.

1.15 Survival Aspects

No one was injured.

1.16 Tests and Research

The heated floor panel, which failed and was deactivated after the Budapest landing, was removed by the airline's maintenance organisation after the ferry flight following the incident and quarantined until it was sent to the French accident investigation organisation (BEA) at the request of the IC. BEA carried out an inspection of the floor panel sent in June 2019 and sent the inspection report to the IC on 31/07/2019. The inspection included visual examination, radiographic examination, resistance measurements and geometric measurements.

Their key findings include that the damage to the burned part was limited to a very small area and that the burn marks are visible in the central core structure of the panel. In their report, they made recommendations for further investigation and recommended that the IC contact the manufacturer. In the report, BEA informed the IC that the problem of panel damage in this case is already known and that a newer version of this type of panel exists. The IC then contacted the manufacturer and asked the BEA representative to send them the heated floor panel for further examination.

In accordance with its procedures, the manufacturer has sent its investigation plan to the IC for approval under number 2019-132. After approval, the examination and measurement included in the investigation plan were carried out and the report on the heated floor panel was submitted under No 2020-098, on 03 September 2020.

During the examination, the manufacturer carried out a detailed visual inspection supported by measurements, and resistance measurements on the damaged heated panel. It was found, inter alia, that the panel showed:

– aluminium bottom skin is porous and missing material in the area of overheat damage (aft edge) *(Figure 3*),

– there were corrosion damages in several places on both the top and bottom skins, resulting in delamination (*Figure 4*),

– there were dents, deep scratches and delamination in several areas on both the top and bottom of the panel.

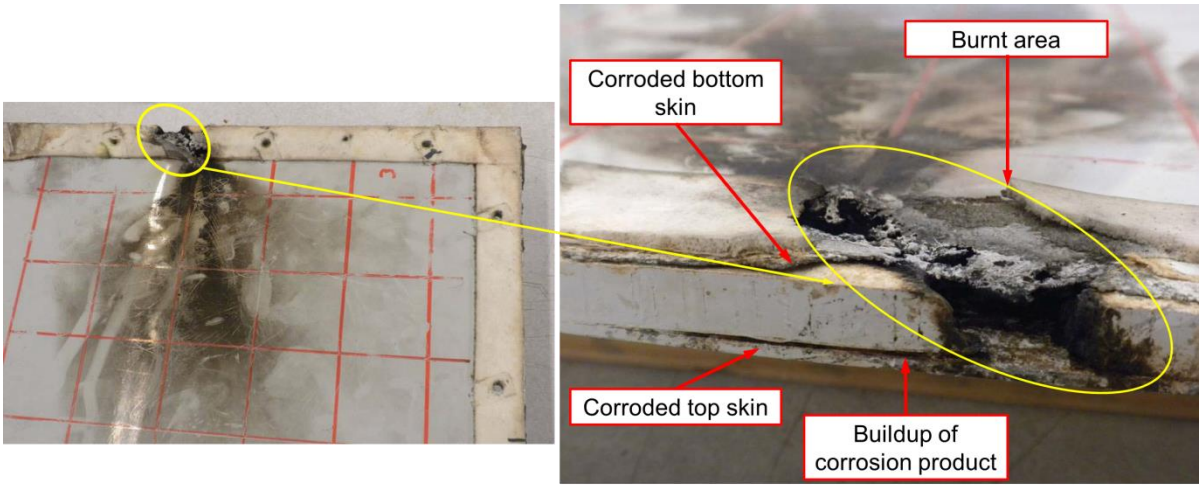

Figure 3: The burnt and deficient area

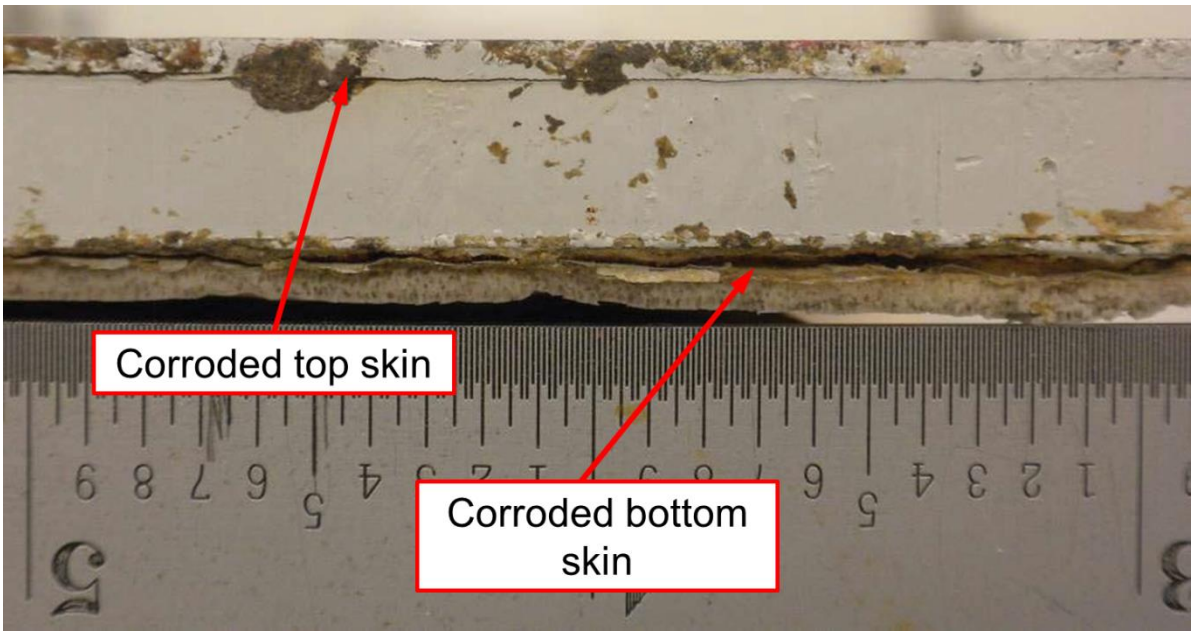

Figure 4: Corrosion marks on the top and bottom shells of the heated panel

When measuring the resistance of the floor panel, the manufacturer found that the resistance of the heater circuit and the temperature sensor element were within the acceptable range, while there was a short circuit in the heating element.

The manufacturer's investigation found that corrosion at the trailing edge of the heated floor panel had led to the failure of the heating element. *(Figure 5)*

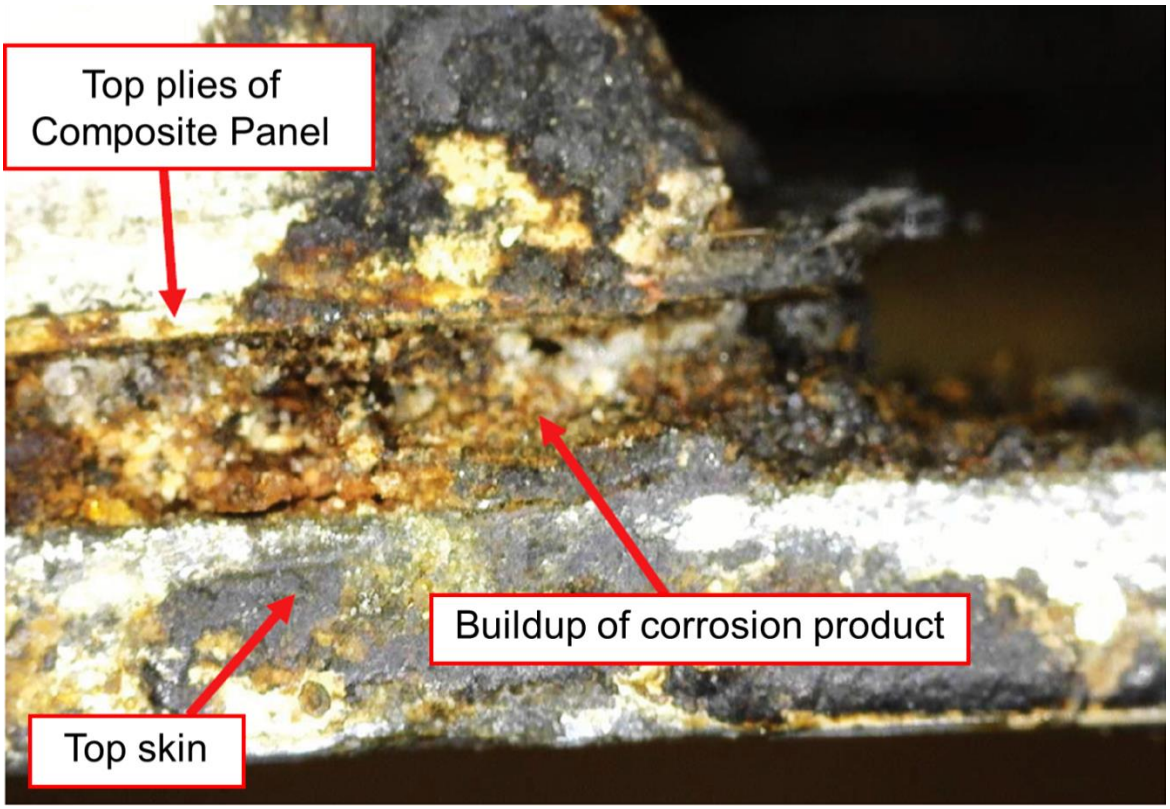

Figure 5: Corrosion product buildup at the trailing edge of a heated floor panel

The process of corrosion failure of an aluminium skin heated floor, based on the manufacturer's assessment, is as follows:

- Damage to the corrosion protection materials (paint, primer) leads to corrosion of the aluminium skins,
- The abrasive corrosion products compromise the dielectric barrier (polyimide film) encapsulating the heater element,
- The heater element becomes connected to ground, leading to a local overheat and locally destroying the heater element.

The manufacturer has found that the corrosion and the resulting heater damage are consistent with past findings.

The floor panel manufacturer's report described the problem with the heated floor panel with aluminium skins and its proposed solutions in the aircraft manufacturer's Service Information Letter (SIL 25-144) and the floor panel manufacturer's investigation reports. Furthermore, they remark that the airframe manufacturer has been installing the newer titanium skin heated floor panels in its newly produced aircraft since 2007.

The Service Information Letter (SIL 25-144) referenced by the floor panel manufacturer and issued by the aircraft manufacturer is dated April 2007 and related to floor panels of similar construction but different part numbers used on A330, A340.

1.17 Organizational and Management information

After receiving the inspection report from the floor panel manufacturer, the operator finalised its investigation report, an extract of which was sent to the IC without attachments on 11 May 2022.

Their analysis included, among others:

- the activities of the flight crew, including their rest periods,

- crew manuals,
- the reliability of the heated floor panels on the A320 family aircraft operated by them.

A package of measures has been developed to solve the problems identified, defining a feedback trail for the implementation of the proposals made.

An analysis of the crew's activities has shown that the flight attendants implemented the fire/smoke procedures in their procedures, but this did not lead to any result. Since the flight recorder does not record the position of the CB in the galley, the investigators were unable to fully verify the actions performed. The reappearance of smoke, its thickening and change of smell (burnt match smell), the flight attendant reported to the flight deck crew, who then did not follow the procedures of the *"Smoke/Fumes/AVNCS Smoke"* chapter of the flight manual consistently, but after assessing the situation they decided immediately to make an emergency landing.

During review of the cabin crew manual, it was found that in the case of electrical smoke, cabin crew may de-energize certain electrical consumers by pulling the CB out after informing and approving the flight crew. However, the disconnection of heated panels associated with this incident was not covered in the manual.

The operator's post-incident assessment of the reliability of the floor panels of the part numbers (P/N) involved in the incident revealed that, between 2017 and 31 December 2018, 15 floor panels had to be replaced due to premature failure (MTBUR). The floor panels inspected during that period had been in service without failure for an average of 19490 hours.

As regards the contents operator's package of measures, the IC mention that:

- to avoid similar incidents, the investigation and lessons learned from the incident have been incorporated into the training programme for the flight crew;
- among others, the Cabin Crew Operations Manual (CCOM) was amended, incorporating the procedures to be followed in the event of a heated floor panel failure,
- in the event of failure of the aluminium skin heated floor panels, they must be replaced with the new titanium skin product.

1.18 Additional Information

The IC received the Service Information Letter (SIL 25-144) referred to in Chapter 1.16 from the floor panel manufacturer, which does not cover the heated floor panel of the aircraft involved in the incident. So the IC has also obtained the manufacturer's information on heated floor panels for the aircraft type family involved in the incident.

On 24 November 2011, the aircraft's manufacturer issued, under 25.27.51.001 reference number, a reliability report (Technical Follow-Up) about the internal heated floor panels which was not affected by the occurrence (part number: 4E4141-X), and about the external floor panels affected by the occurrence (part number 4E4140-X) (*Appendix 1*:).

In that Technical Follow-Up, among other things, it was determined that the inner panels were the most affected by panel heater failure, and therefore the development of a stronger internal panel was envisaged. No modification is intended for the external 4E4140-X panels, taking into account the results of the reliability study. In this Technical Follow-Up, they mention that the power supply to the heated floor panels can be activated/deactivated by using the corresponding circuit breaker (CB) in the front galley (2000VU).

Subsequently, on 18 February 2016, the aircraft manufacturer issued a Technical Follow-Up (No 25.27.00.007) for the Airbus 320 family, containing information on typical damage to front door heating panels and recommendations for their solution (*Appendix 2*:). That Technical Follow-Up is specifically related to the products of the manufacturer of the heated floor panel involved in the incident.

This leaflet describes that for heated floor panels with an aluminium skin, corrosion, the delamination of floor layers or mechanical impact (trolley[1], moved by cabin crew, movement of passengers) can lead to electrical failure of the heated floor panel, which can result in overheating and the smell of smoke in the cabin.

According to the leaflet, the power supply to the heated floor panel can be cut off in-flight by pulling out the circuit breaker (CB) in the front galley after informing the flight crew. The process for this should be developed by the operators and included in the cabin crew operations manual.

It also provides information for maintenance staff and for flight attendant and emphasizes the need to avoid dropping heavy/sharp objects and using trolleys that are too heavy, both during maintenance and when serving passengers.

And as a permanent solution, it recommends using the new titanium skin heated floor panels instead of the aluminium skin ones, as the titanium skin resist corrosion and mechanical stresses due to their stronger design.

1.19 Useful or Effective Investigation Techniques

The investigation did not require techniques differing from the conventional approach.

[1] trolley: a trolley used by the cabin crew to serve passengers

2. Analysis

2.1 Crew Activity

The IC does not have sufficient information to analyse the activities of the flight crew, as the flight data recorder does not record the status of the CB in the front galley and the IC does not have any evidence on the communication within the cabin (1.11), and in the operator's report in several points there are only assumptions about crew activity.

2.2 Heated Floor Panel

At the time of the incident, the problems with the failure of the aluminium skin heated floor panels were known to both the aircraft and the panel manufacturers (1.16, 1.18). The investigation of the floor panel had similar results to the examinations of malfunctions reported by the other operators prior to the incident. These results indicate that the short circuit of the heating element occurs among others due to mechanical damage and corrosion. The manufacturer of the panel has, as a definitive solution to these problems, developed a new titanium skin heated floor panel, which is stronger and therefore provide better robustness against mechanical impact, and the titanium skin is more resistant to the corrosion than the aluminium skin.

The information letters published by the aircraft manufacturer contain a solution for older floor panels in case the failure is associated with a short circuit and resulting smoke. It is highlighted that the heating circuit of the panels can be disconnected/isolated by pulling out the appropriate circuit breaker (CB) on the CB panel in the front galley of the aircraft. The procedure for this operation should be developed by the operators and incorporated in their own manuals. Based on the report received from the operator, the cabin crew operation manual and crew fire/smoke procedures were amended after the incident.

The information letters published by the aircraft manufacturer contain guidance on how to prolong the service life of these floor panels, avoiding the dropping of heavy and sharp objects and the use of excessively heavy trolleys. The IC also considers it important to mention that the service life of heated floor panels can be further extended by taking into account the weather conditions. In many cases, for example in the event of sudden rainstorm or heavy snowfall, the IC has found that the service staff often reacts too late to these circumstances and forgets to close the doors. In such cases, a lot of precipitation can reach the floor panels and places where it can greatly accelerate corrosion processes. According to the IC, this process can be greatly slowed down if more attention is paid to these conditions and how to avoid them.

As the aircraft manufacturer's publications also provide guidance on how to deal with failures in the use of older aluminium skin floor panels in addition to the final solution, the IC does not propose to TSB issuing a safety recommendation.

In IC's opinion similar failures could occur in the future, despite the fact that they are known to the manufacturer and operators. However, as regards the replacement of aluminium panels with titanium skin panels, the operator is the cost-bearer and its replacement is not mandatory, so the IC's opinion is that the decision of the operator will be based on financial considerations. The probability of a more serious outcome than the failure in the present incident is low, but the cost of replacing the floor panel is high, and therefore the operator has presumably considered the possible risk to be negligible. In the opinion of the IC, that the manufacturer did not require the replacement of the floor panels with titanium skin ones because the possibility of a failure associated with fire is so small that, in their opinion, it does not require the issue of an airworthiness directive.

3. Conclusions

3.1 Findings

3.1.1 Aircraft

The aircraft was serviceable. (1.1, 1.6.1)

The aircraft had a valid airworthiness certificate. (1.6.2)

No damage was caused to the main structural elements of the aircraft involved in the occurrence. (1.1, 1.3, 1.4, 1.12)

It is documented as being equipped in line with the regulations in force and the agreed procedures. (1.1, 1.6)

The investigation did not reveal any information that the aircraft structure or any of its systems had failed prior to the incident, thereby contributing to or influencing the occurrence of the incident. (1.12)

The aircraft was equipped with the navigation equipment specified in the type-certificate and no observations were made by or reported to the IC regarding the functioning of such equipment. (1.8)

The aircraft was equipped with the communication equipment specified in the type certificate and no related observations were made by or reported to the Authority. (1.9)

3.1.2 Flight Crew or Pilot

At the time of the incident, the flight crew had the appropriate licenses and ratings and had the appropriate experience for the flight task. (1.5)

The last training of the flight crew took place within 3 months before the incident. (1.5)

The rest period for the flight crew was as required. (1.5)

Following the evaluation of the incident, the pilots decided to make an emergency landing. (1.1, 1.17)

3.1.3 Air Operations

The aircraft’s mass and balance were within the specified limits. (1.6.3)

The weather conditions did not affect the course of the occurrence. (1.7)

About five minutes after take-off, the flight attendants smelt the odour of burning wires, but were unable to identify the source. (1.1, 1.17)

3.1.4 Malfunctioned Equipment

During the incident, the external aluminium skin heated floor panel at the front left (1L) entry door failed with a burnt smell and heavy smoke. (1.1, 1.6.4, 1.16, 2.2)

Both the BEA and the floor panel manufacturer have informed the IC in their reports that the problem of the panel under investigation had already known and that solutions were available. (1.16, 1.18, 2.2)

The failure of the heated floor panel could be traced back to mechanical damage, corrosion and associated delamination, which in many cases was accompanied by a short circuit of the heating element and consequently by visible smoke. (1.1, 1.6.4, 1.16, 1.18, 2.2)

Both the aircraft and the floor panel manufacturer have definitive solutions to failures caused by mechanical damage and corrosion, using a new titanium skin with a more robust design that is more resistant to corrosion as well. (1.6.4, 1.16, 1.17, 1.18, 2.2)

The aircraft manufacturer has a solution for the use of aluminium skin floor panels as well. (1.16, 1.17, 1.18, 2.2)

3.1.5 Operator

The operator has made an internal investigation based on the information collected. (1.17, 2.1)

After analysing the information collected, the operator prepared a package of measures to take. (1.17, 2.1)

The operator has initiated a replacement programme for aluminium skin heated floor panels in the event of failure, to replace them with titanium skin panels. (1.17, 2.1)

3.1.6 Data Recorders

The required data recording systems for the air traffic control equipment and the aircraft were operational and the data they recorded was evaluable. (1.11)

The aircraft flight data recorder does not record data on the closed or open status of the circuit breaker (CB) located on the CB panel in the front galley. (1.11)

3.1.7 Fire

There was no fire on the aircraft, but there was visible smoke with strong odour for an extended period of time before landing. (1.1, 1.17)

3.2 Causes

As a result of the investigation the IC concluded that the root cause of the incident was an electrical short circuit of the heating element due to corrosion of the outer edge of the heated floor panel with part number 4E4140-1.

4. Safety Recommendations

4.1 Actions Taken by the Operator During the Investigation

The operator formulated risk mitigation measures in the context of the incident in its internal investigation, which it has made available to the IC. The IC reviewed the operator's report during the investigation and took note of the findings.

4.2 Interim Safety Recommendation

The IC of the TSB found no grounds to issue a safety recommendation.

4.3 Concluding Safety Recommendation

The IC of the TSB found no grounds to issue a safety recommendation.

The IC of TSB did not find any circumstances that would justify a safety recommendation, as the aircraft manufacturer's had already developed the permanent solution and issued the information about the handling of the failures with the older aluminium skin floor panels also.

Dated in Budapest, on 14 March 2023

Mr. Gábor Erdősi
Investigator-in-Charge

Ms. Kitti Dusnoki
Investigator

APPENDICES

Appendix 1:

WISE Technical Follow-Up AIRBUS

HEATED FLOOR PANEL RELIABILITY ISSUE

ATA:	**25-27**	FIN:				Ref:	**25.27.51.001**
A/C Type:	**A318 A319 A320 A321**	A/C Serie:		Potential Impact:	**Operational Reliability Line Maintenance**	First Issue Date:	**30-APR-2009**
Part Number:		Key Information:				Last Publication Date:	**24-NOV-2011**
Supplier:	**GOODRICH CORPORATION**	Solution Benefit:					
Linked Articles:		Linked Documentation:	**SB 25-1755**				
Linked FAIR-ISP:	**09.0059**					Status:	**Closed**

Engineering Support

Fault Code/ECAM Warning:		First Issue Date:	**30-APR-2009**
Model:		Last Publication Date:	**24-NOV-2011**
Manufacturer:			
		Status:	**Closed**

Issue Description

On A318/A319/A320/A321 aircraft, several airlines experienced issues (overheating, burn smell in cabin, etc) with the Heated Floor Panels fitted in door 1 area:
- outer panels 4E4140-X series, located at FIN 30DS & 31DS.
- inner panels 4E4141-X series, located at FIN 32DS & 33DS.

Up to now, most cases occurred after 6000 Flight Hours with the inner panels (FIN 32DS and 33DS) mainly impacted.

Consequence

As the Heated Floor Panels cannot be repaired (only paint touch-up allowed), when they fail, operators have the following possibilities:
- either continue to operate the aircraft with Heated Floor Panel deactivated (considering the structural integrity of the panel is not affected)
- or replace the failed Heated Floor Panel by a new one.

Investigation Status

Investigations (Visual examination, microscopy and teardown analyses, roller tests) have been performed at Goodrich and Airbus facilities on the defective Heated Floor Panels removed from the affected aircraft.

Inner panels:
Above investigations have shown that high loading (or impacts) on the panel upper surface lead to:

1 - crack initiation in the corner of the cut-out areas, on the bottom of the HFP,
2 - crack propagation (with cycles) up to the panel top layer reaching the heating element,
3 - crack on the heating element , which generates a short circuit.

Outer panels:
In service feedback has shown that the outer panels are much less affected than the inner ones.
From the investigation, it can be stated that the root cause for these few cases is probably linked to delamination/corrosion

Mitigation / Interim Plan

N/A

Maintenance Information

HFP can be temporarily replaced by standard floor panels (preferably during C check).

Repercussion on A/C Dispatch

N / A

Solution

Inner Heated Floor Panels:
The root cause has been clearly identified and the development of new robust inner panels has been launched.
The selected solution consists in structural reinforcement of the HFP, adding:
- formed thick shell to bottom of the panel at lead wire area, and
- reinforcement plates to bottom of the panel at sensor and thermostat pocket level.
The status for solution availability is as follows:
- MOD 152275 covers the introduction of the new inner HFP PN 4E4941-X. This MOD has been certified on 12-Sep-11.
- SB 25-1755 (based on MOD 152275) dispatched on the 14-Nov -2011.

Outer Heated Floor Panels:
The outer panels have a different design than the inner ones. In-service feedback has shown that these panels are less prone to be affected by heating element failure. The investigation of the few outer panels returned, clearly demonstrates that no weakness has been identified in the outer panel structure.
Therefore, for the time being, no modification is foreseen for the outer HFPs.

OPS Information

HFP can be activated/deactivated by using the corresponding circuit breakers on the 2000VU forward cabin compartment Circuit Breaker panel (Circuit Breakers 51DS & 52DS for 115VAC and 54DS for 28VDDC, as per AMM task 25-27-51-000-002).

Relevant Documentation

IPC 25-27-00

Appendix 2:

Heated Floor Panel / typical damage and associated recommendations

ATA:	25-27	FIN:	30DS 31DS 32DS 33DS			Ref:	25.27.00.007
A/C Type:	A318 A319 A320 A321	A/C Serie:		Potential Impact:	Operational Reliability Pax comfort Line Maintenance Material Management	First Issue Date:	06-FEB-2015
Part Number:		Key Information:				Last Publication Date:	18-FEB-2016
Supplier:	GOODRICH CORPORATION	Solution Benefit:	Maintenance Cost Pax comfort Operational Reliability				
Linked Articles:		Linked Documentation:					
Linked FAIR-ISP:						Status:	Closed

Engineering Support

Fault Code/ECAM Warning:		First Issue Date:	06-FEB-2015
Model:		Last Publication Date:	18-FEB-2016
Manufacturer:			
		Status:	Closed

Applicability:

A320 family aircraft. This TFU only relates to Heated Floor Panels (HFPs) installed at door1 and manufactured by UTAS (former Goodrich).

Reference / Documentation:

CCOM chapter 09-020
CCOM chapter 02-080.
AMM 25-28

Description

Operators report several damage of Heated Floor Panel. Damage can be separated in following types:

- Corrosion (most reported damage)
- Delamination
- Mechanical impact

These damage can lead to electrical failure of the HFP (becoming inoperative) or overheat, leading to fumes or smoke in cabin.

Consequence

On A320 family, it is possible to deactivate HFP in flight.
Indeed, if an HFP overheat event occurs (with smoke/fume) in flight, it should be detected by cabin crew. Then, cabin crew should apply "GUIDELINES FOR IN-FLIGHT SMOKE AND FIRE MANAGEMENT" available in CCOM chapter 09-020. This guideline recommends in particular to inform flight crew directly, and states that:
Quote
Circuit breakers that relate to cabin items, such as lights, and entertainment systems, etc..., may be used to isolate equipment in the event of smoke and fire, in accordance with the operator's policy.
Unquote
Information about C/B panel 2000VU is also given in CCOM chapter 02-080.

Nevertheless, HFP overheat has already led to Operational Interruptions (delays, IFTB, RTG).

Note: It is also possible to install an ON/OFF switch HFP on the FAP, through optional MOD 34686 (RFC process).

Investigation Status

Corrosion of HFP aluminium foil is due to water ingress on HFP area.

Delamination can be due to corrosion, but also to hard NTF removal (edge delamination).

Mechanical impact can be due to one shot impact (object falling on galley area floor), then with fatigue (trolley or PAX passage), crack can propagate til HFP heating element.

Mitigation / Interim Plan

See maintenance information chapter

Maintenance Information

For corrosion issue, Airbus recommend to:
- ensure proper condition and installation of the NTF, paying particular attention to sealing/ welding areas.
- replace NTF/Mylar foil in case of significant damage finding (AMM 25-28).
- ensure overlap of Mylar (50mm) during installation or repair.

For delamination issue, Airbus recommend to:
- ensure that NTF removal/installation is performed with care, as per appropriate AMM procedure 25-28-42.
- even if no rule, replace NTF every 3 years (also recommended by NTF manufacturer).

For mechanical impact issue, Airbus recommend to:
- pay attention during maintenance/catering activities, to avoid heavy/sharp object fall on HFP or use of heavy trolley.

Permanent Solution

The above maintenance recommendations are always valid. Nevertheless, please be advised that new HFP with Titanium foil (instead of Alu foil) is available since mid 2016 (MOD 157406) (installation proposed via interchangeable parts via IPC).
Such HFP installation should prevent corrosion issue, and provide better robustness against mechanical impact.