Published August 2012

Report

Serious incident on **15 April 2010**
south-east of Brive-la-Roche (19)
to the **Hawker Beechcraft Corporation Beech B200GT**
registered **F-HSFA**
operated by **SEFA**

BEA
Bureau d'Enquêtes et d'Analyses
pour la sécurité de l'aviation civile
Ministère de l'Ecologie, du Développement durable et de l'Energie

Foreword

This report expresses the conclusions of the BEA on the circumstances and causes of this incident/accident.

In accordance with Annex 13 to the Convention on International Civil Aviation and with European Regulation n° 996/2010, the investigation was not conducted so as to apportion blame or to assess individual or collective responsibility. The sole objective is to draw lessons from this occurrence which may help to prevent future accidents.

Consequently, the use of this report for any purpose other than for the prevention of future accidents could lead to erroneous interpretations.

SPECIAL FOREWORD TO ENGLISH EDITION

This report has been translated and published by the BEA to make its reading easier for English-speaking people. As accurate as the translation may be, the original text in French is the work of reference.

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Glossary

CPL	Commercial Pilot Licence
HBC	Hawker Beechcraft Corporation
IR-ME	Instrument rating - Multi Engine
SEFA	Service d'Exploitation de la Formation Aéronautique

Synopsis

Date
Thursday 15 April 2010 at 20 h 30[1]

Place
Around 15 NM south-east of Brive-la-Roche (19) aerodrome, in cruise at FL 230

Type of flight
Ferry

Aircraft
Hawker Beechcraft Corporation (HBC) Beech B200GT

Owner
DEXIA BAIL SA

Operator
SEFA[2]

Persons on board
2 Flight crew

[1] All times in this report are UTC, except where otherwise specified. Two hours should be added to express official time in metropolitan France on the day of the incident.

[2] As the merger between SEFA and ENAC (Ecole Nationale de l'Aviation Civile) in 2011 took place after the incident, the SEFA acronym has been used in the drafting of this report.

SUMMARY

Cruising at flight level 230, the crew noticed that the cabin heating system, on automatic mode, was not providing heat. They tried the system in manual mode then detected smoke in the cabin. They put on oxygen masks, declared an emergency situation and carried out an emergency descent. The smoke stopped during application of the procedure associated with this situation. The aeroplane landed in Toulouse without further problems.

A warm air duct under the cabin floor was found to be split. A sheet of aluminium around the split and the grey adhesive which was overlaid on it both bore traces of overheating.

1 - HISTORY OF FLIGHT

1.1 History of Flight

The crew was performing a ferry flight from Melun Villaroche (77) aerodrome, where the aeroplane was usually based, to Toulouse Blagnac (31) airport.

In cruise at flight level 230 at night, the crew were cold and noticed that the cabin heating system, on automatic mode, was not providing heat. They selected manual mode and turned on the MAN TEMP switch for warm air.

A few moments later, acrid smoke penetrated the cabin. The captain and co-pilot put on their oxygen masks, switched off the heating, declared an emergency situation with the en-route controller at 20 h 24 min and began an emergency descent to flight level 100. They carried out the emergency procedure associated with the presence of smoke in the heating system.

The en-route controller transferred the crew on approach to Toulouse indicating that they should plan an approach to runway 14 left.

Radio contact with Toulouse approach was made at 20 h 27 min. The crew noticed that the smoke had stopped but maintained their urgency situation. At 20 h 33 min, they requested a fire-fighting team on landing.

The aeroplane landed at 20 h 44 min.

1.2 Personnel Information

1.2.1 Captain

Aged 39

- ❒ Commercial Pilot's License, IR-ME rating and a BE90/99/100/200 type rating
- ❒ Experience:
  - total: 4,665 flight hours including 520 hours on type
  - in the previous three months: 38 hours including 19 on type

His last training course on a cabin smoke situation was carried out early February 2010.

1.2.2 Co-pilot

Aged 44

- ❒ Commercial Pilot's License, IR-ME rating and a BE90/99/100/200 type rating
- ❒ Experience :
  - total: 9,000 flight hours including 100 hours on type
  - in the previous three months: 80 hours including 9 on type

His last training course on a cabin smoke situation was carried out in September 2008.

1.2.3 Mechanic

Aged 40

- Holding:
  - Part 66 Aircraft Maintenance Licence issued 26 August 2008, acquired according to experience criteria (“grandfather”)
  - A SEFA in-house qualification enabling him to provide an approval for release to service in a specified field
- Experience:
  - Employed for 18 years by SEFA and spent almost all his career in the Melun centre. He participated in work on Be200 for a number of years

1.3 Aircraft Information

1.3.1 Airframe

Manufacturer	Hawker Beechcraft Corporation
Type	Beech B200GT
Series number	BY-16
Registration	F-HSFA
Entry into service	8/11/2007
Certificate of Airworthiness	valid
Use on 15 April 2010	636 flight hours

1.3.2 Air conditioning system

The aeroplane was equipped with an air conditioning system ensuring cabin pressurisation as well as the distribution of air at the requested temperature.

Warm bleed air from each engine is cooled, partially or completely, in the wing heat exchangers. For each of them, a bleed air bypass valve enables the quantity of bleed air circulating in the heat exchanger to be adjusted and thus modulates the temperature of the warm bleed air obtained before distributing it in the cabin.

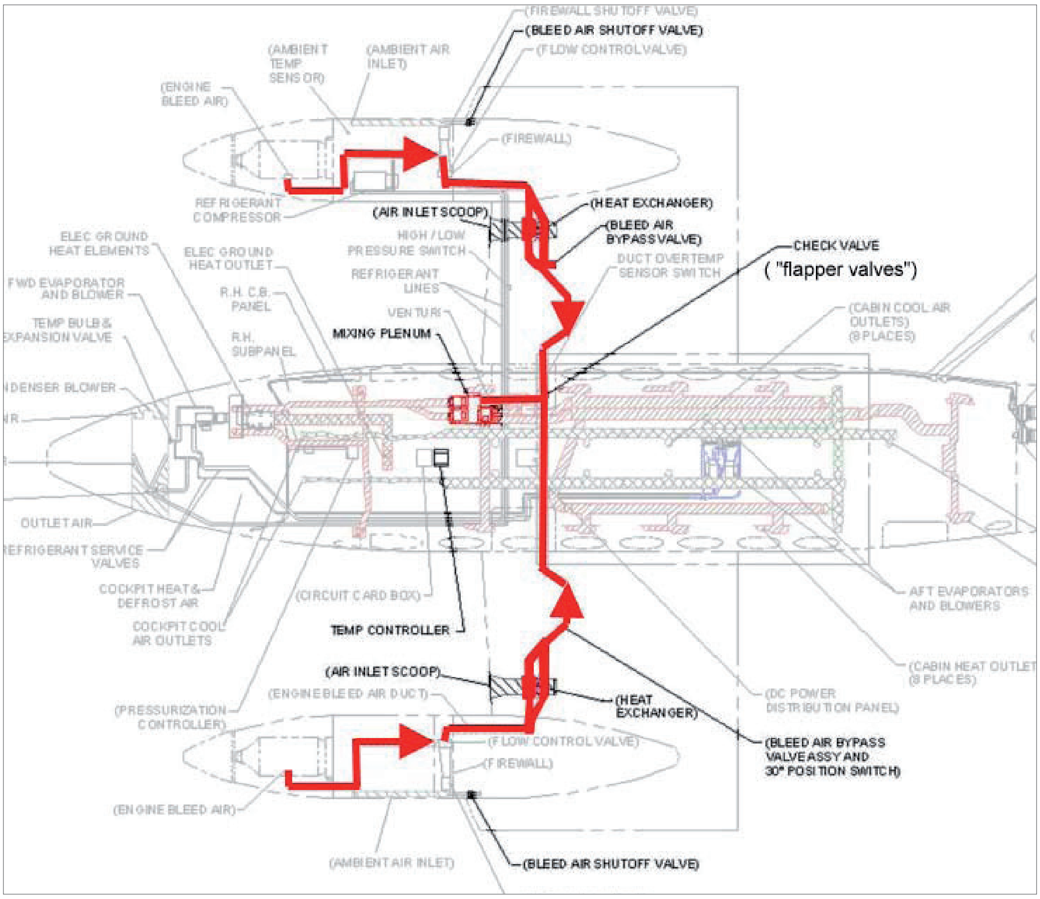


Figure 1: Overall diagram of pressurisation, air conditioning and heating system

Downstream of the exchangers, the right and left warm air ducts lead to a metallic T-shaped sleeve, under the cabin floor, on the right side.

In the event of engine failure, inside this sleeve flapper valves prevent the flow of air from the other engine from feeding the duct connected to the failed engine. The outlet from this sleeve feeds a flexible sheath (ref. 515 in the diagram below) fixed to a venturi (ref. 510), itself fixed to a distribution system whose valves ensure the distribution of warm air in the cabin.

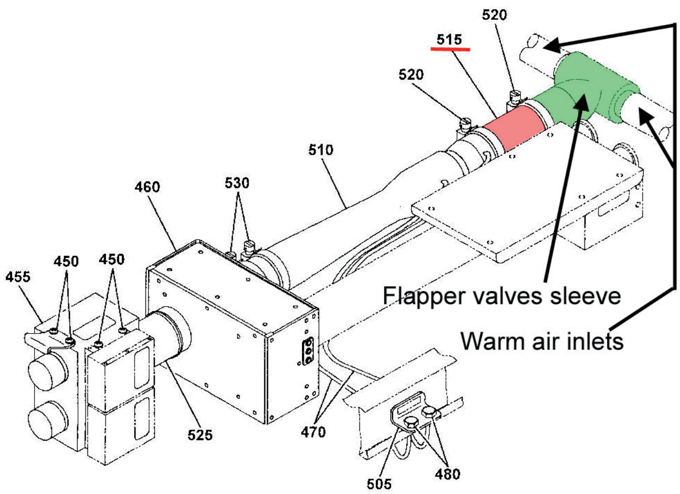


Figure 2: Drawing of the warm air distribution system

In order to limit heat loss, this equipment is wrapped in rock-wool type insulation held in position by aluminium adhesive.

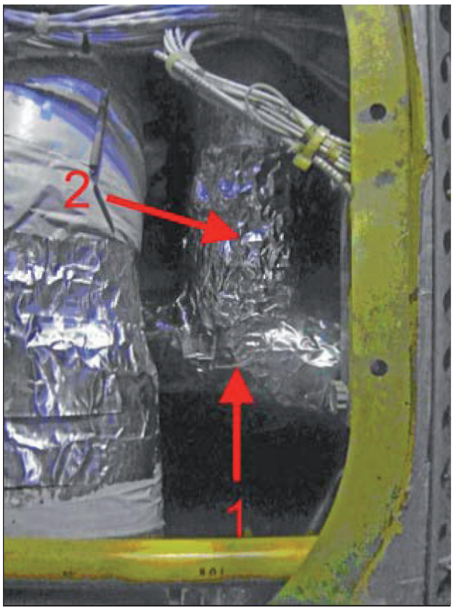


Figure 3: The “flapper valves” sleeve (1) and the sheath (2) wrapped in their heat insulation

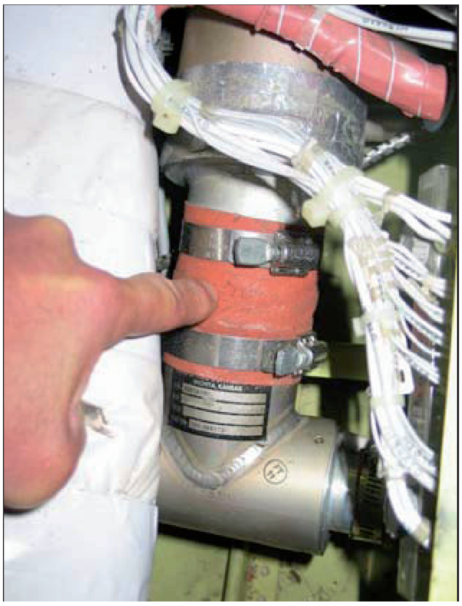


Figure 4: The same equipment after removal of heat insulation

The control panel for this system is located on the right side of the instrument panel:

Figure 5: Control panel

In automatic mode (MODE switch on AUTO), a temperature controller controls the position of the various valves according to the temperature measured in the cabin and the temperature required, set by the rotating TEMP controls.

A manual heating mode can be used by setting the MODE switch to MAN HEAT. In this case:

- the bleed air by-pass valves remain in the last position set in automatic mode
- the distribution valves are fully open
- the MAN TEMP switch enables the temperature of the warm air to be increased or decreased by opening or closing the bleed air by-pass valves. As the temperature controller no longer regulates temperature, the temperature should be increased by short touches on the switch in order to avoid a sudden rush of heat(3). Pushing for about one minute makes the valves move from one extreme to the other

(3)This precaution is detailed in the flight manual, in section 7 “Description of systems” as well as a word of caution on the risk of overheating in case of excessive use of the MAN TEMP switch.

A leak detection system is installed along the heating sheaths. It works on the principle of melting a tube pressurised by the bleed air pressure system. The heat of the leak provokes the tube melting, leading to a drop in pressure inside the tube. This drop in pressure triggers a visual warning (L BL AIR FAIL or R BL AIR FAIL).

Lastly, detection of overheating is ensured by a thermostatic contactor located in the venturi section controlling the lighting of a sign (OVERTEMP DUCT) as soon as the temperature exceeds 300 °F.

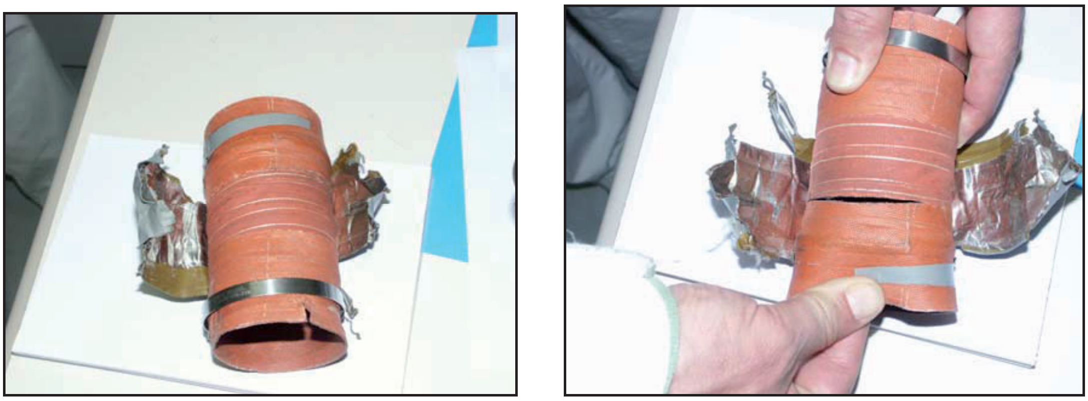
1.4 Meteorological Conditions

The meteorological conditions at Toulouse Blagnac were visual flight conditions.

1.5 Tests and Research

1.5.1 Source of the smoke

The maintenance operations carried out after the incident showed that the flexible sheath (ref. 515 in figure 2) was split and surrounded by a grey adhesive overlaid on a sheet of aluminium. They both bore traces of over-heating and were ripped:



Figures 6 and 7: Flexible sheath split with its adhesive

In the photograph below, taken after the removal of the sheath, the metallic sleeve of the flapper valves and the entry of the venturi (in the centre) can be seen. The sheath area does not show any traces of over-heating.

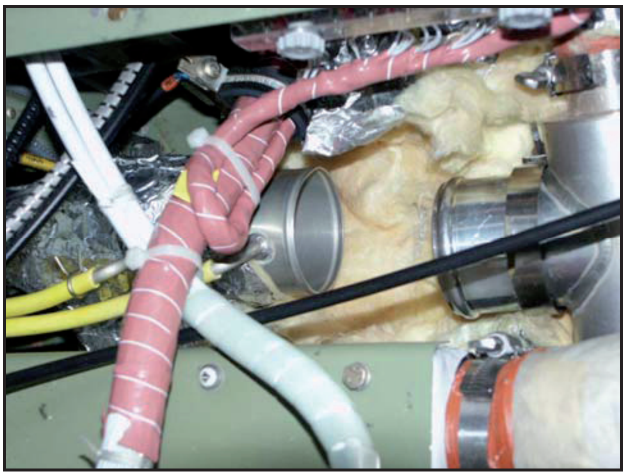


Figure 8: Sheath area.

1.5.2 Summary of maintenance operations

The aeroplane was delivered new to SEFA in March 2008. UNI AIR at le Bourget (93) carried out the work associated with importing the aeroplane. Within the framework of the guarantee, in June 2008 the company carried out a failure search following an anomaly in the heating system operation and then replaced the rear warm air distribution sleeve. The distribution sleeve was close to the split sheath. Replacing it did not require the sheath to be dismantled.

<u>Programmed service carried out from 25 June 2009 to 8 July 2009 by the Melun SEFA centre</u>

The smooth operation of the flapper valves was checked during a phase 3+4 type service visit, in accordance with the SEFA maintenance programme approved by the Direction Générale de l'Aviation Civile (DGAC). There were no other checks of this equipment between this date and the date of the incident.

SEFA A 0140
Centre de MELUN

PROTOCOLE DE VISITE B200
Phase 3+4 planifié edition3 amdt2 06_08

zone	Operations
F.23	RÉGULATEUR DE PRESSION PNEUMATIQUE, TROMPE D'ÉVACUATION et SOUPAPE DE DISTRIBUTION DÉGIVRAGE Examiner les équipements et les raccords pour en vérifier la bonne fixation.
F.12	CONDUITS DE PRESSURISATION Examiner pour s'assurer de leur bonne fixation.
F.14	CLAPET À BATTANT Vérifier le bon fonctionnement et l'absence de bruit d'air excessif des « flapper valve ».
F.31.a	SYSTÈME DE CONDITIONNEMENT D'AIR Examiner les conduits pour en vérifier l'état et l'installation sûre.

Figure 9: Extract from the maintenance programme

<u>Heating anomaly noticed on 9 March 2010</u>

A flight crew noticed the non-function of the heating in automatic mode. An inspection was carried out by the Melun SEFA centre that did not enable the failure to be reproduced.

<u>Work carried out after the incident flight by UNI AIR in Toulouse</u>

- Replacement of the temperature controller (p/n 201-0750-2 replaced by the p/n 201-0750-3) according to information available on the aeroplane manufacturer's website which mentioned this possibility to solve occasional initialisation failures occurring on a few pieces of equipment of this type when powered on[4]
- Replacement of the faulty sheath
- Ground test and line tests indicating no anomaly

In conclusion, no exchange and no repair of the damaged sheath appeared in the maintenance documents from the time of delivery of the aeroplane to the incident.

[4]HBC stated that this reference had also been included in the updated "Illustrated Parts Manual" to which the SEFA was a subscriber, so that operators order and receive new equipment in case of failures in the old. HBC did not issue a "Communiqué" or a "Rommended Service Bulletin", due to the occasional nature of the failure, the manual mode remaining available, and the consequences of this failure affecting the comfort of the occupants, but not flight safety.

1.6 Information on Organisations and Management

1.6.1 Aeroplane servicing

The Melun SEFA centre handles the management of the aeroplane's continued airwothiness as well as servicing operations (whether scheduled or not). It employs eight mechanics and carries out the maintenance of fifteen aircraft, including 4 Beech 200 and unpressurised piston-powered aeroplanes.

This workshop, like the other SEFA workshops, reports to the Technical Department which includes in particular a study service responsible for monitoring technical domentation. SEFA has been Part 145 (FR.145.618) approved since 1st July 2009[5]. As such, it has a Maintenance Organisation Specifications Manual (MOE-SEFA) that describes the organisation and the general procedures associated with maintenance operations. This document allows for the possibility of adapting maintenance procedures prescribed by a manufacturer to recognise local constraints. This possibility is allowed for in the Part 145 regulation (paragraph 145.A.45 (d).

[5]It had the status of Approved Maintenance Facility prior to this date.

Occasionally, specific interventions are requested from UNI AIR, which has Part 145 approval (FR.145.243).

1.6.2 Procedure for repairing air distribution ducts

The maintenance manual drawn up by HBC does not mention a solution for repairing these ducts. In the event of damage, they must be replaced.

1.6.3 Inspection procedure of the flapper valves

The procedure prescribed by the manufacturer described in the maintenance manual consists of checking the absence of air flow at the air duct outlet located in one of the nacelles while the opposite duct is powered by the working engine. The same process is used for the left duct with the right engine operating, then for the right duct with the left engine operating. A copy of the procedure is appended to this report.

If no air flow is observed, the test is satisfactory. If air flow is observed, the flapper valves sleeve must be dismantled for a visual inspection of the correct positioning and condition of the valves. In this case, the access flap in the cabin must be taken down, previously cleared of its equipment, then the thermal insulation wrapping the sheath and the sleeve must be removed for the inspection and change of sleeve. The insulation must then be put back in place and the access flap closed. The technique to use for removing the thermal insulation is not described in this manual.

A record of flapper valve inspection procedures was requested from the manufacturer HBC. It appears that this procedure was introduced in August 1986 and that the principle described above had not changed.

1.6.4 OSAC supervision

During audits of the maintenance workshop, OSAC did not notice any difference relating to the application of the procedure prescribed by the manufacturer. An audit does not allow for the comprehensive check of all the procedures applicable by the workshop. In this case, during the last audit in October 2008 preceding the maintenance operation in summer 2009, the application of this procedure was not checked.

1.7 Additional Information

1.7.1 The crew's testimony

The crew indicated that they were cold and noticed that the heating was not working satisfactorily in automatic mode. They tried to get heat in manual mode. Shortly afterwards, they detected a burning smell that got stronger. Acrid and irritating smoke appeared, seeming to come from the front of the cockpit, mainly from the right side.

They put on oxygen masks, shut down the heating (MODE switch on OFF), began the emergency descent and application of the "Environmental system SMOKE or FUMES" procedure:

ENVIRONMENTAL SYSTEM SMOKE OR FUMES

1. **Oxygen Mask(s) .... DON**
2. **Mask Selector Switch .... EMERG POSITION**
3. **MIC Switch(es) .... OXY**
4. ECS Mode .... MAN HEAT
5. Cockpit/Cabin Blower .... AS REQUIRED
6. Left Bleed Air Valve .... ENVIR OFF

If Smoke Decreases:

7. Continue operation with left bleed air off.

If Smoke Does Not Decrease:

8. Left Bleed Air Valve .... OPEN
9. Right Bleed Air Valve .... ENVIR OFF

If Smoke Decreases:

10. Continue operation with right bleed air off.

If Smoke Persists:

11. Bleed Air Valves .... ENVIR OFF
12. Cabin Pressurization .... DUMP
13. Storm Window (if required) .... OPEN
14. Land .... NEAREST SUITABLE AIRPORT

Figure 10: "Environmental system SMOKE or FUMES" procedure

They noticed a lessening of smoke after setting the Left Bleed Air Valve switch to OFF.

The two members of the crew explained that the use of masks and integrated microphones hampered their communication with each other and with the air traffic controller. They had to speak louder than usual to be heard.[6]

[6]No technical malfunction linked to the use of masks was highlighted after the incident. Following the incident, SEFA included mask fitting and testing during recurrent training on B200GT for crew familiarisation.

1.7.2 Testimony of the head of the maintenance unit

The head of the maintenance unit worked in this workshop for a number of years. He initially held the position of mechanic before moving to this management position.

In Spring 2008, in the context of the purchase of the F-HSFA, he took a training course in servicing the aeroplane in the USA. He explained that before this course in the workshop, the flapper valves were systematically inspected visually by removing the thermal insulation of the sheath to access the sleeve and visually inspect the valves. During this training course he became aware, among a number of other pieces of information, of the test procedure described in the maintenance manual and indicated in chapter 1.6. On his return, he indicated this procedure from time to time to other mechanics at the workshop. Transmission of this information was not formalised further, for example during a meeting of the workshop mechanics. Specific equipment was developed locally in order to allow the engine shut down test (generating air with a compressor connected to the air duct) and in this way enabling the work organisation of the service visit to be optimised and preventing the risks linked with engine running operations. This equipment can be used on the F-HSFA but not on one of the SEFA Beech 200 (F-GJFA) because of a different configuration of the air ducts.

He indicated that the removal of the thermal insulation was usually carried out by trying to unstick a piece of aluminium adhesive. This procedure was used in short steps to access the sheath and sleeve. The use of a sharp tool was prohibited because of the risks of damage. On re-assembly, the thermal insulation was placed in direct contact with the sheath, then held tightly in contact with it by applying aluminium adhesive.

The workshop did not systematically use the work cards accurately describing the operations to be carried out to successfully accomplish an identified maintenance task, except for onerous tasks such as changing an engine. There were no work cards for simple tasks.

Technical meetings in the workshop, to discuss problems encountered and share experience, were rare in 2008. They have become more frequent since then. Driving the process of detection and rectification of maintenance errors via “Observation forms” described in the MOE-SEFA is also gradually becoming more accepted, like the “human factors” approach.

1.7.3 Testimony of the mechanic

The mechanic intervened on all types of aircraft used in the centre for a number of years (single-engine and piston-powered twin-engines, Beech 200). In February 2009, he followed a training course on maintenance of this aeroplane. This training course lasted two weeks, was in English and covered general points. Prior to this date, he had never followed a training course specific to working on a Beech 200 airframe. He acquired his experience “on the job” within the workshop.

He explained that in June or July 2009, during a scheduled service of F-HSFA, he was asked to conduct the flapper valves test planned in the maintenance programme. For this operation, the servicing programme did not explicitly refer to a test procedure. The mechanic therefore used the procedure he usually used for this test on SEFA’s other aeroplanes of the same type, meaning dismantling the connection between the damaged sheath and the T-shaped sleeve of the flapper valves to carry out a visual inspection of the valves.

The mechanic pointed out that he occasionally used electronic documentation accessible to the workshop and used the series numbers to identify the procedures that applied. The individual series numbers were not always all mentioned explicitly. The use of the phrase “n° XXXX and following” is common. This documentation was in English which sometimes caused comprehension difficulties for the mechanic. He did not consult this documentation on the day of the intervention as he had no reason to think that the procedure described could differ from the one he usually carried out.

Thus, the mechanic:

- Removed the access flap located on the cabin floor to access the equipment
- Used a cutter to neatly open the thermal insulation surrounding the sheath and the T-shaped sleeve. The mechanic explained that it was the first time this equipment had been dismantled since delivery of the new aeroplane. Consequently, the insulation surrounded the warm air circuit neatly, without protrusions or visible access path from a previous dismantling. The use of a cutter seemed to him to offer the best guarantees for a clean opening and closing of the insulation layer
- He made an incision perpendicular to the axis of the sheath. He did not realise that the incision had reached the sheath. Then he moved away the insulation
- He withdrew the sheath from the sleeve by loosening the collar that ensured it was attached, then drew the T-shaped sleeve upwards. This compressed the sheath in the incision zone, which did not facilitate detection
- Visual inspection of the valves did not reveal any anomaly
- The mechanic’s recollection of the re-assembly operations was not very precise as the operation was done 20 months before the interview with the investigators. He thought that during the re-assembly operations, he surrounded the sheath with a strip of adhesive aluminium on which he added a grey adhesive. He thought that he wanted to proceed in this way in order to improve the sheath insulation. As the aluminium adhesive did not adhere well on the sheath material, he added a grey adhesive to hold it in place. He remembered that there was no more aluminium adhesive in the workshop or in the storehouse. He no longer remembered how he got it. The grey adhesive, often used to protect air ducts in engine nacelles, came from the store. He then reconnected the sheath to the sleeve and put the insulation back in place

The mechanic added that an inspection by another mechanic was not mandatory for this operation. He did not remember if he had asked a colleague to come and check his work.

Lastly he explained that a service of this type required about two weeks’ work if there were no supply problems or other major maintenance operations for the workshop on other aeroplanes. Generally, 5 technicians shared the tasks programmed in the service. He thought there were 3 during the service in question, which took place during the summer holiday period. He did not think he had acted in haste or under time pressure.

2 - ANALYSIS

2.1 Scenario

The crew encountered a failure of the heating system in automatic mode. It possibly originated from a fault in the temperature controller solved by a change in this equipment (see 1.5.2). The crew then passed over to manual mode.

The investigation showed that the acrid irritating smoke came from the deterioration of the adhesives in contact with a damaged warm air duct. The weakening of the latter from damage and the crew's manual request for heat, difficult to control and thus more sudden than in automatic mode, exposed the adhesives to a greater heat than they could tolerate. The air flow and temperature were not enough to trigger the overheating and leak detection systems.

The smoke stopped when the crew reduced the air flow in the duct by setting the "Left bleed air valve" switch to OFF.

2.2 Inappropriate Maintenance Actions

Examination of the maintenance documents and interviews with the workshop employees meant that actions that led to the duct damage and adhesive application could be identified.

The damage to the duct was made with a sharp instrument, in principle prohibited for this type of action. Use of this method was however deemed by the mechanic to be the best adapted to neatly undo the thermal insulation envelope that had never been opened since the aeroplane's construction. The damaged adhesives were not present at the disassembly (they were not prescribed by the manufacturer) and their addition was also the result of an individual decision.

This event illustrates the risks associated with individual initiatives taken without prior consultation with colleagues.

2.3 Practices in the workshop and documentation

This damage and the use of additional insulating adhesives are even more inappropriate as the dismantling of the sheath could have been avoided by carrying out the functional flapper valves test prescribed by the manufacturer.

It appeared that this procedure had been in force for a number of years and that the head of the maintenance unit only became aware of it by participating in a training course in the context of the aeroplane purchase. On his return, the transmission of this information was clearly not sufficient to change behaviour and bring everyone's practices into compliance with the maintenance manual. The creation of specific piece of equipment enabling a functional test to be conducted without powering the engines is however a tangible sign of recognition of this information. It should be noted that this material was not usable on all Beech 200's serviced by the workshop. When it was not usable, respecting the manufacturer's procedure imposed constraints on the deployment of the engines, complicating the organisation of the various maintenance tasks. It is understandable that the disassembly of the sheath could be deemed more convenient, all the more so since this had been the practice for a number of years.

Nevertheless, occasional disassembly of the flapper valves sleeve cannot be excluded, for example when the functional test was not satisfactory. It was therefore especially the disassembly and re-assembly procedure that should be specified, as well as the associated risks.

It is in this spirit that some remarks should be made on the maintenance documentation and its use which are not intended to limit the individual practices observed: the maintenance programme mentions the operations to be carried out and a succinct description of the procedures to follow, but does not include a reference to the page in the maintenance manual that could encourage the mechanic to check if the procedure that he wants to use is really the one prescribed. The maintenance manual procedure does not specify the technique to use, nor to avoid, to remove thermal insulation. The mechanic's testimony showed that he was not comfortable with this documentation and the English language. SEFA's drafting work cards adapted for the test, the disassembly and the reassembly of the flapper valves sleeve would seem to be of interest to validate and formalise the methods to use, particularly as the workshop had already developed tools and an adaptation of the method prescribed by the manufacturer.

3 - CONCLUSION

3.1 Findings

- The crew had the qualifications required to carry out the flight.
- The airworthiness certificate was valid.
- In cruise mode, the crew noticed incorrect operation of the heating system in automatic mode, they then chose manual mode then activated the switch enabling the temperature of the warm air to be increased.
- The flight manual contains a caution on the risk of the sheath overheating in the event of use in manual mode.
- Smoke appeared in the cabin.
- The crew applied the procedure prescribed in the event of smoke in the cabin and began an emergency descent.
- The production of smoke stopped.
- A sheath in the warm air supply system was discovered to be split. The adhesives surrounding the split part had partially melted.
- This sheath was damaged with a sharp instrument during a maintenance operation to check the smooth working of the flapper valves of the warm air power supply case.
- For this inspection, the manufacturer's procedures recommend first of all a functional test followed, in the event of an anomaly picked up during this test, by disassembly of the sleeve. The functional test was not carried out.
- The manufacturer's maintenance documentation does not provide a repair solution for this type of sheath.
- The adhesives surrounding the split in the sheath were not present at the disassembly and were added during the re-assembly.
- OSAC did not bring to light any difference with the manufacturer's procedure for checking the flapper valves.

3.2 Causes of the Serious Incident

The production of smoke came from the melting of adhesives attached to a warm air duct damaged by a maintenance action undertaken with an inappropriate sharp instrument.

The following factors contributed to the incident:

- The mechanic's lack of awareness of the procedure prescribed by the manufacturer and its adaptation in the workshop, which led him to carry out an unnecessary disassembly and during which the damage occurred.
- Inadequate formalisation within the workshop of the procedure to follow for the test and the disassembly of the flapper valves sleeve.

4 - SAFETY RECOMMENDATION

Note: In accordance with Article 17.3 of European Regulation (EU) 996/2010 of the European Parliament and Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation, a safety recommendation shall in no case create a presumption of blame or liability for an accident, a serious incident or an incident. The addressee of a safety recommendation shall inform the safety investigation authority which issued the recommendation of the actions taken or under consideration, under the conditions described in Article 18 of the aforementioned Regulation.

The investigation showed that the damage to the sheath causing the smoke was the result of a mechanic's individual initiative made possible by lack of awareness for several years of the test procedure prescribed by the manufacturer and its recent and as yet unformalised adaptation in the workshop. The regulations allow for the possibility of a maintenance organisation adapting the maintenance instructions to its activity.

Consequently, the BEA recommends that:

- **OSAC list the documentation and maintenance practices relating to the test and dismantling of flapper valves in workshops responsible for maintenance of BE 200's; [Recommendation FRAN-2012-019]**
- **OSAC ensure that they comply with the manufacturer's references or with an adaptation defined according to the arrangements in Part 145. [Recommendation FRAN-2012-020]**

Flapper valves checking procedure

The procedure in force at the time of maintenance operations in the summer 2009 is shown below:

Hawker Beechcraft Corporation

SUPER KING AIR 200 SERIES MAINTENANCE MANUAL

DISTRIBUTION - MAINTENANCE PRACTICES (BB-2 THRU BB-1977, BB-1979 THRU BB-1987; BL-1 THRU BL-152; BT-1 AND AFTER; BN-2 AND AFTER)

INFORMATION

NOTE: Special Tools and Equipment/Consumable materials called out by the procedures in this chapter are individually identified by Item No., Chart No. and the referenced Chapter where the corresponding specification, product and supplier/manufacturer are listed.

EQUIPMENT/MATERIALS	ITEM NO., CHART NO., (REF.CHAP.)
Tape, Aluminum Foil, Pressure Sensitive (3 x 0.002 inch)	57, Chart 201, (Ref. 20-15-00)
Industrial Oven Insulation, (2-inch)	58, Chart 201, (Ref. 20-15-00)

NOTE: The right hand electronic flow control valve was initially installed in the inverted position. On airplanes BB-1313 and after; BT-34 and after; BL-152 and after; and BN-5 and after, the right hand electronic flow control valve was rotated 180° and installed right side up.

ENVIRONMENTAL BLEED AIR DUCTS

The bleed air ducts are insulated with 2-inch-thick industrial oven insulation (Item No. 58) held in place with 0.002-inch-thick, 3-inch-wide, aluminum foil tape (Item No. 57). The tape should be wrapped in a spiral with approximately 1-1/2-inch overlap. The tape and insulation may be compressed as required to maintain a clearance of 0.25 inch from adjacent hardware.

CAUTION: *To prevent damage to the airplane electrical system, maintain a minimum clearance of 2 inches between uninsulated bleed air lines and any electrical wiring. The clearance requirement may be reduced to 0.5 inch if the bleed air lines are insulated.*

CHECK (FLAPPER) VALVE TEST PROCEDURE

The check (flapper-type) valve should be checked for proper operation or if excessive air noise is noted during operation of the pressurization system (Ref. Chapter 5-20-00). The following steps should be utilized for the check valve test:

a. Disconnect the air duct at the left flow control valve or remove the cap from the test fitting on elbow if installed (Ref. Figure 201).

b. Operate the right engine with both bleed air switches on. If no significant air flow is noted at the open duct, the duct may be reconnected to the flow control valve or reinstall cap removed in step (a).

c. Shut down the right engine.

d. Disconnect the air duct at the right flow control valve or remove cap from test fitting on elbow if installed.

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e. Operate the left engine with both bleed air switches on. If no significant air flow is noted at the open duct, it may be reconnected to the flow control valve or reinstall cap removed in step (d).

f. If no significant air flow was noted at either of the open ducts during the test procedure, the check valve flappers are operating properly. If significant air flow was noted at either of the open ducts during the test, the check valve must be replaced and the downstream ducts must be examined to assure that none of the check valve components are lodged in them.

CHECK (FLAPPER) VALVE REMOVAL

a. Remove furnishings as required to clear the right seat area from (F.S. 167.00 to 188.00).

b. Remove the carpet and soundproof material as required to gain access to the cover plate over the check valve (F.S. 169.00 to 184.00).

c. Remove the inspection cover.

d. Remove the tape and insulation from the check valve and connecting hoses (Ref. Figure 202).

e. Loosen the clamps on the connecting hoses and remove the check valve.

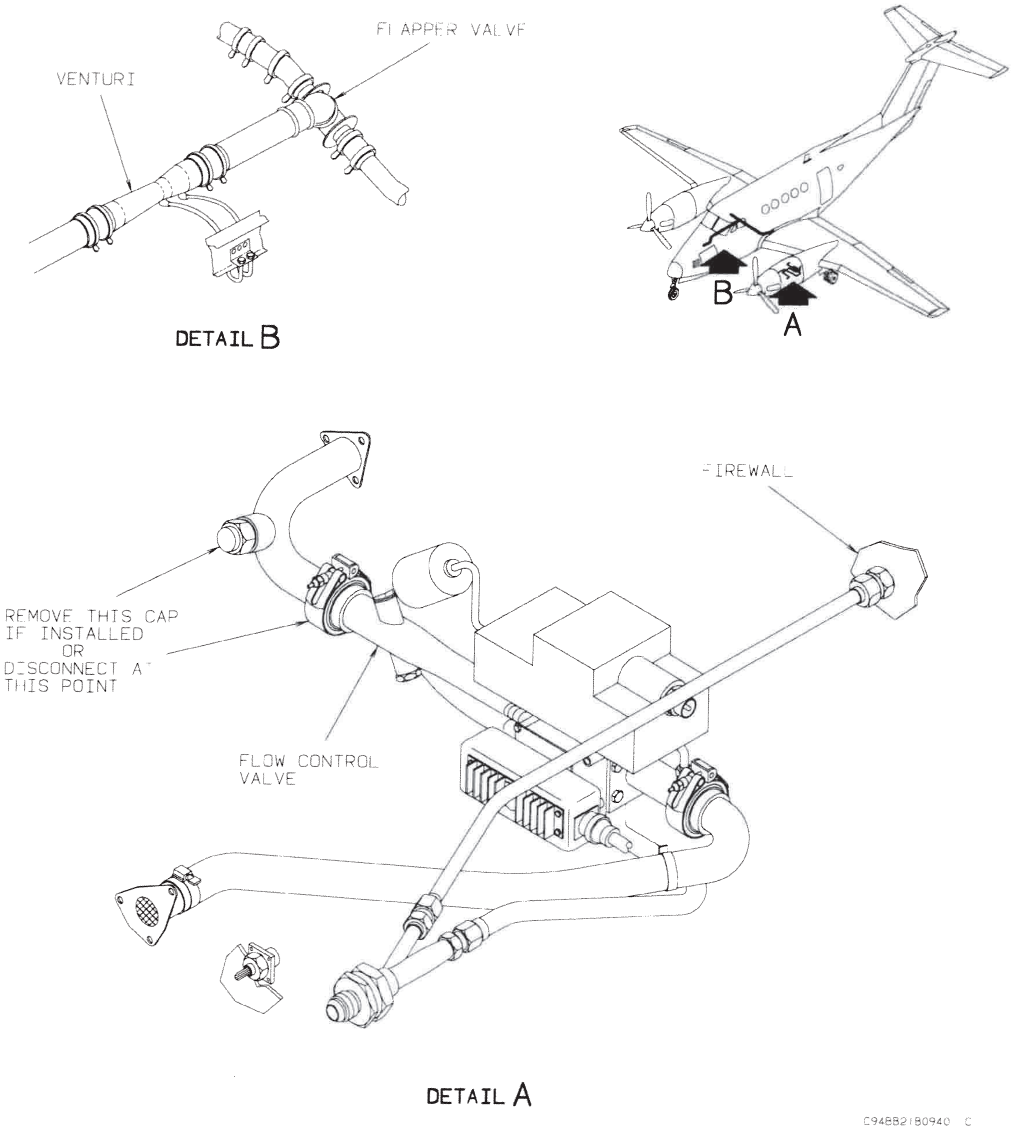
NOTE: It may be necessary to slide the hoses back on the ducts in order to gain sufficient clearance to remove the check valve.

CHECK (FLAPPER) VALVE INSTALLATION

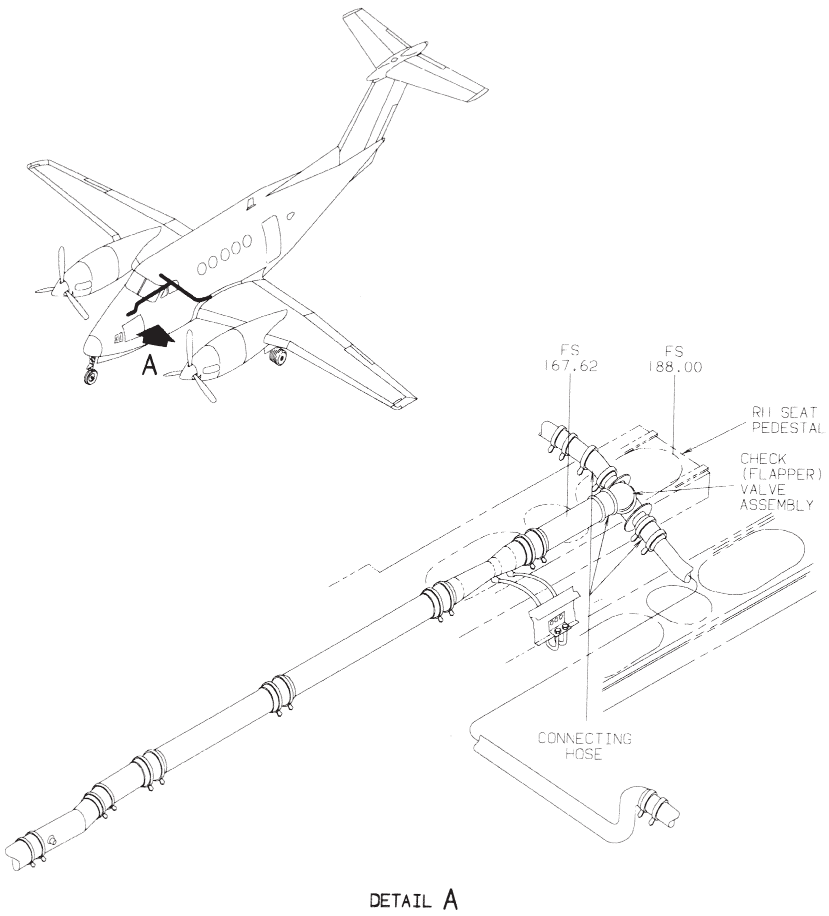
a. Position the check valve in line with the ducts and slide the connecting hoses onto the valve (Ref. Figure 202).

b. Tighten the attaching clamps and reinstall the insulation and tape.

c. Install the inspection plate, soundproofing, carpet and furnishings.



Check (Flapper) Valve Test Procedure
Figure 201



Check (Flapper) Valve Replacement Procedure
Figure 202

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