KÖZLEKEDÉSBIZTONSÁGI SZERVEZET

TRANSPORTATION SAFETY BUREAU

FINAL REPORT

002/2006

INCIDENT

Budapest aerospace

5th January 2006 19:10 LT

HA-LHB

B767-27GER

The sole objective of the technical investigation is to reveal the causes and circumstances of aviation accidents, incidents or irregularities and to initiate the necessary technical measures and make recommendations in order to prevent similar cases in the future. It is not the purpose of this activity to apportion blame or liability.

This present investigation was carried out on the basis of

- Act XCVII of 1995 on aviation,
- Annex 13 of MTW Decree 20/1997. (X. 21.) on the declaration of the annexes of the Convention on International Civil Aviation signed in Chicago on 7th December 1944,
- Act CLXXXIV of 2005 on the technical investigation of aviation, rail and marine accidents and incidents (hereinafter referred to as Kbvt.),
- MET Decree 123/2005 (XII. 29.) on the regulations of the technical investigation of aviation accidents, incidents and irregularities,
- In the absence of other related regulation of the Kbvt., the Transportation Safety Bureau of Hungary carried out the investigation in accordance with Act CXL of 2004 on the general rules of administrative authority procedure and service,
- The Kbvt. and the MET Decree 123/2005 (XII. 29.) jointly serve the compliance with the following EU acts:
  a) Council Directive 94/56/EC of 21 November 1994 establishing the fundamental principles governing the investigation of civil aviation accidents and incidents,
  b) Directive 2003/42/EC of the European Parliament and of the Council of 13 June 2003 on occurrence reporting in civil aviation.
- The competence of the Transportation Safety Bureau of Hungary is based on the Kbvt. until 31st December 2006 and on Government Decree 278/2006 (XII. 23.) from 1st January 2007 respectively.

Under the aforementioned regulations

- The Transportation Safety Bureau of Hungary shall investigate aviation accidents and serious incidents.
- The Transportation Safety Bureau of Hungary at its own discretion can investigate other not serious aviation incidents and irregularities which - in its judgement - would have resulted in accident in other circumstances.
- The technical investigation is independent of any administrative, infringement or criminal procedures.
- In addition to the aforementioned laws, the ICAO DOC 6920 Manual of Aircraft Accident Investigation is applicable.

Abbreviations

AC	Alternating Current
ACE	Aeroplex of Central Europe
AFL	Aircraft Flight Log
ATPL	Airline Transport Pilot Licence
BITE	Built In Test Equipment
BUD-JFK	Budapest-New York (Kennedy Airport)
CAA	Civil Aviation Authority, Hungary
EICAS	Engine Indicating and Crew Alerting System
ETOPS	Extended range Operations with two-engine aeroplane
FL	Flight Level (1 FL=100 feet)
IC	Investigating Committee
LT	Local Time
OCC	Operation Control Centre
P/N	Part Number
S/N	Serial Number
TSB	Transportation Safety Bureau of Hungary
UTC	Universal Time Coordinated
YYZ-BUD	Toronto-Budapest

Short summary

Event category	Incident due to the fault of the environmental control system
Aircraft manufacturer	The Boeing Commercial Airplane Co. U.S.A.
Type of aircraft	B767-27GER
Registration number	HA-LHB
Owner	MALCO LLC
Operator	MALÉV Zrt.
Date and time of the incident (UTC)	5th January 2006. 19.10 LT
Location	Hungary, Budapest aerospace

On the basis of the location of the incident, the competent investigating organization is the Transportation Safety Bureau of Hungary (hereinafter referred to as **TSB**)

Synopsis

At 19 hours 15 minutes on 5th January 2006, the Flight Safety Department of Malév Plc. was notified (by Malév Operation Control Centre – OCC) that the pressure controller system on Malév flight No. MAH090 was not operating satisfactorily. Then the Flight Safety Department informed the TSB dispatcher on duty, first via mobile phone then via fax. The TSB dispatcher reported the case to the Director-General of TSB and the officer on duty at CAA.

The Pressure Controller System worked normally after take off in Budapest, however, when climbing over the level of FL190, the 'CABIN ALT' sign came on. After descending under FL100, the system could only provide the required cabin pressure by manual control as the problem still existed when switching over from AUTO1 to AUTO2. The cabin crew in consultation with the technical personnel at Ferihegy decided to turn back the flight for technical and economical reasons. After flying for an hour, the conditions for overweight landing were suitable; therefore they landed at 19 hours 33 minutes at Ferihegy. The Auto 1 Controller was replaced by the technical personnel due to its failure then a ground test was carried out and no error was found.

Subsequently, the aircraft completed a BUD-JFK route with the same pressure controller problem. At JFK airport, the system was checked by the technical personnel of Delta Airlines and everything was found in order. After the JFK-BUD route, the AC motors which operate the Outflow valve were replaced due to the previous error.

After the replacement, the aircraft executed several flights without pressure control problem.

The next pressure control error occurred on 9th January on route YYZ-BUD.

After landing and shut-off in Budapest, the following signal came on: „CABIN ALT AUTO1, CABIN ALT AUTO2, AUTO INOP". However, the aircrew personnel did not detect any error during the flight.

Having regard to the recurrence of the error, a further test and error-correction was carried out on the aircraft in addition to the required check. After the replacement of the devices and the AC motors as well as checking the wiring, the heads of the operator decided to execute a qualification test flight during which the operation of the whole system can be checked.

The test flight was executed on 12th January, during which the Pressure Controller System worked normally in each checkpoint. Since the test flight, the IC has not had knowledge of the error of this system either by checking the documents or by any other way.

The Director-General of TSB appointed Sándor Sipos (Head of the Aviation Department) to be the Head of the IC and János Horváth (accident investigator engineer) to be the member of the IC.

During the investigation, the IC reviewed the relevant documents and repair logs, then analysed and evaluated them.

The IC established that the incident had been induced by the fault of the Cabin Pressure Controller (P/N: 2117388-13).

The Draft Report prepared by the IC was sent to the bodies concerned (CAA and MALÉV Plc.) on 31st August 2006. MALÉV Plc. sent its concurring opinion on the Preliminary Report within the time specified in the applicable law.
Having regard to this, TSB confirms and publishes the Draft Report prepared by the IC without substantial change.

1. Factual information

1.1 History of the flight

The Boeing B767-27GER type aircraft - registration mark: HA-LHB - departed at 18 hours and 30 minutes LT with the assigned aircrew personnel and 160 passengers aboard to execute Budapest – New York scheduled flight No. MAH090.

After take off, the cabin crew noticed that the “CABIN ALT” sign and the “EICAS CABIN ALT” error message came on at FL190. Therefore the crew started to descend at the time of the appearance of this signal in order to adjust the level of cabin pressure automatically by system No. 2. As this attempt proved unsuccessful under FL100, cabin pressure was set manually. The cabin crew consulted the maintenance personnel about this error and decided to make an emergency landing to Ferihegy Airport with the conditions of overweight landing 1 hour and 3 minutes after the take off. The reasons behind this decision were technical and economical.

After landing, the maintenance organisation (ACE) carried out transit daily check and the required check for overweight landing. In order to correct the error, Cabin Pressure Controller No. 1 was replaced (P/N: 2117388-13; S/N: 62-A0512 instead of S/N: 113-607). The system worked normally at the ground test, then the aircraft was sent to BUD-JFK route at 21 hours 55 minutes LT. However, when approaching the destination airport (JFK), an error message appeared again on the EICAS screen at FL130. (AFL1056150 registration: „CABIN ALT AUTO1” STATUS MSG COMES ON”). During the transit check, Delta technical personnel checked the system as well but did not detect any error on the ground. After the aircraft’s arrival in Budapest – due to the above mentioned error message – the maintenance personnel replaced the AC motors operating the Outflow valve with motors in stock. As it later turned out, this replacement was not necessary since the error reoccurred later. (Subsequently, this device was detached and the original device was reinstalled.)

After these checks, the aircraft executed several routes, then on 9th January, following the landing and shut-off in Budapest, „CABIN ALT AUTO1, CABIN ALT AUTO2, AUTO INOP” message appeared on the EICAS screen. As this was a recurring, frequent error-message concerning the system, thorough troubleshooting and examination proved to be necessary.

The captain documented the error-message wrongly on the AFL of the previous flight (on no. 1071856 instead of no. 1071857). The captain confirmed this in an interview and the IC accepted it as a fact when reviewing the Toronto copy of the AFL. The wrong documentation did not influence the actual repair work.

In the course of the error correction, the Cabin Pressure Controller (in AUTO2 system) was replaced with a new type (P/N: 2117388-15 type instead of P/N: 2117388-13).

This replacement is recommended by Boeing on Service Letter 767-SL-21-064-B as it reduces the probability of Cabin Pressure Controller failure.

The wiring from the control panel to the Cabin Pressure Controllers and from the Controllers to the outflow valve was checked. On the basis of the decision of Aeroplex Engineering Service, the outflow valve was replaced and the previously detached drive motors were reinstalled. The reason for this is that the AUTO1 Controller registered an AC motor error as well.

A qualification test flight was prescribed on 12th January to classify the AC motors and to make sure that the ETOPS significant system of the outflow valve works normally. Although the qualification test flight is not prescribed, it was executed in order to avoid further recurrence of errors. The pressure controller system worked normally during all the check-ups and this was documented on BOEING B767 TEST FLIGH DATA SHEET No. 12/01/2006/01.

Neither the aircrew personnel, nor the technical personnel have experienced any error in the pressure controller system since the qualification test flight. The IC confirmed this when reviewing the aircraft log of January and February.

1.2 Injuries to persons

Injuries	Crew	Passengers	Others
Fatal	0	0	0
Serious	0	0	0
Minor	0	0	0
None	**2/5**	**160**	0

1.3 Damage to aircraft

None.

1.4 Other damage

The IC has no information about other damage.

1.5 Personnel information

1.5.1 Information on the Commander

Gender and age	Male, aged 56 years
Licence	ATPL
Licence valid	31. 03. 2006.
Last proficiency check	09. 10. 2005.
Qualification	B767 Captain
Type rating	B767/CP
Medical certificate	21. 05. 2006.
Total number of flight hours	17153 hours
Total number of flight hours on type B767-27GER	8328 hours

1.5.2 Information on the First Officer

Gender and age	Male, aged 28 years
Licence	ATPL
Licence valid	31. 03. 2006.
Last proficiency check	06. 08. 2005.
Qualification	B767 First Officer
Type rating	B767/F/O
Medical certificate	04. 03. 2006.
Total number of flight hours	1930 hours
Total number of flight hours on type B767-27GER	605 hours

1.6 Aircraft information

1.6.1 Airframe information

Type	Boeing B767-27GER
Manufacturing number	27049
Date of manufacturing	1993
Manufacturer	Boeing Commercial Airplane Co.
Number of airworthiness certificate	LHB 4453
Certificate valid	09. 12. 2006.
Total flight time	53761 hours 7004 cycles, 4638 days
Last overhaul	-

1.6.2 Type of engines CF6-80C2-B4F

1.6.3 Left engine information

Serial number (S/N):	702865
Date of installation	19. 02. 2002.
Total engine time	41815 hours and 5440 cycles

Right engine information

Serial number (S/N):	703142
Date of installation	27. 11. 1999.
Total engine time	54265 hours and 7062 cycles

1.6.4 Aircraft load information

Weight of fuel at take-off	53500 kg
Weight of fuel at landing	47900 kg
Take-off gross weight	175993 kg
Take-off actual weight	161300 kg
Landing gross weight	126098 kg
Landing actual weight	155700 kg

The loading of the aircraft and its distribution was within the prescribed limits and was in no connection with the incident.

1.7 Meteorological information

The incident happened at night with good visibility.

The meteorological conditions did not influence the occurrence.

1.8 Aids to navigation

The navigation systems of the aircraft worked as prescribed and they did not have an effect on the occurrence of the incident.

1.9 Communications

The communication between the aircraft and the air traffic control was as prescribed and did not have an effect on the occurrence of the incident.

1.10 Aerodrome information

Not applicable.

1.11 Flight recorders

The Flight Data Recorder (FDR) and the Cockpit Voice Recorder (CVA) worked normally in the course of the incident. The analysis of the data from FDR and CVA was not needed.

1.12 Wreckage and impact information

Not applicable.

1.13 Medical and pathological information

Not applicable.

1.14 Fire

Not applicable.

1.15 Survival aspects

Search and rescue were not necessary as there was no life-threatening situation.

1.16 Tests and research

There was no need for tests and research.

1.17 Organisational and management information

The operator was in possession of the following licences at the time of the incident:

Name of licence	date of issue	Valid until
air operator certificate	28. 04. 2005	30. 04. 2006.
operating licence	28. 04. 2004.	until recalled
maintenance system approval statement	28. 04. 2005	29. 04. 2006.
approval certificate hu.145.0066	28. 07. 2005	31. 07. 2006.
operating licence	31. 12. 2003.	31. 12. 2008.
operating licence	08. 04. 2004.	until recalled
certificate: en ISO 9001:2000	16. 07. 2003.	30. 06. 2006 annual revision

1.18 Additional information

None.

1.19 Useful or effective investigation techniques

The IC did not apply new investigation techniques.

2. Analysis

Based on the available data, information and documentation and the statement of the Commander as well as his report, the Investigating Committee (hereinafter referred to as IC) analyses the incident as follows:

According to the IC, the technical condition of the aircraft at the departure of flight No. MAH090 on 5th January proved faultless.

At the time of the check after the take-off, the Pressure Controller System worked normally, then when stepping over the level of FL190, the 'CABIN ALT' sign came on. The cabin crew sank back under FL100 where the switches and settings were checked and were found in order. As the problem still existed when switching over to AUTO2 system, the required level of pressure was set manually. Since the required level of pressure would have had to be kept manually in the entire duration of flight MAH090, and the reversal would only have been possible after the elimination of the error by JFK maintenance personnel, the cabin crew in consultation with the maintenance organisation decided to turn back the flight. The reason behind the decision was primarily economical.

Based on the available information, the maintenance organisation of ACE (air traffic shift) detected and corrected the error adequately. The accurate and immediate error-correction - deriving from the characteristics of the system - cannot always be realised

entirely. This is what happened in the present incident. After the first error-correction (as it later turned out there had also been further corrections) and the device replacement (Cabin Pressure Controller), the flight was released to its destination with some delay as the ground test showed positive results. However, when approaching the destination airport, the Pressure Controller showed an error again. The exact error description registered into the AFL on paper No. 1056150 is as follows: "DURING DESCENT AROUND FL130 "CABIN ALT AUTO1" STATUS MSG COMES ON"!

The engineering personnel of Delta Airlines executed the self check - BITE - test of the system which resulted in the error message of the AC motor. The system was submitted to power-on test and operational test, however, as no error was detected, after executing the transit check the aircraft was qualified as airworthy.

On surveying the AFLs, in the “Corrective action taken” section, two “Cabin Outflow Valve Actuator” AC motor replacements were documented on paper no. 1056151 (JFK-BUD) referring back to the previous AFL. The justification of the replacements is questionable as such error was not documented in the AFL, however, the two consecutive error messages can somewhat explain the replacements. As the IC referred to it earlier, it is the characteristic of the system that the immediate and definitive error-correction cannot always be realised on the ground. (Ground tests are not equivalent with air operation.)

After the replacements, the aircraft executed several flights without pressure control error until 9th January.

After the landing of flight YYZ-BUD and shut-off on 9th January, the following EICAS message came on: "CABIN ALT AUTO1, CABIN ALT AUTO2, AUTO INOP"

The aircrew personnel did not detect any error in the operation of the system.

During the error-correction, the AUTO2 Controller was replaced as the BITE check indicated an error in the device. However, this time a new subtype was built in, P/N 2117388-15 type instead of P/N: 2117388-13. A Boeing Service Letter (767-SL-21-064-B) permits the replacement entrusting the decision to the operator. Along with the replacement of no. 2 Controller, according to the decision of the ACE Engineering Service, the outflow valve was also replaced when the AC motors - which were previously detached from the stock valve - were reinstalled as the AUTO1 Controller registered AC motor error as well.

As a result of several replacements, assembly stripping and resetting, the personnel taking part in the error-correction concluded that the consecutive stripping of the system and recurrent errors can indicate that a qualification test flight is required; however, it is not made obligatory by the manufacturer. The argument in favour of the test flight is that this is an ETOPS significant system, therefore the IC agrees that the safety level can be raised this way. Especially considering that the error occurred more than once but only during the flight, and the defective device could not be identified unequivocally during the ground tests.

Note

A number of the documents were filled out illegibly or were hardly readable, which made it difficult to establish the facts and gather information subsequently.

3. Conclusion

The aircraft was adequately prepared for flying and it had a valid airworthiness certificate.

The aircrew personnel were competent and authorised for flying and acted rightly in the course of the incident.

The incident was directly induced by the failure of the Cabin Pressure Controller (P/N: 2117388-13). It is beyond doubt that the technical failure causing the recurrence cannot be originated in an inadequate detection and correction of a particular error, however, it can be stated as a fact that the error could only be eliminated after repeated detections.

The failure was no fault of the operator of the flight.

The IC has not found any other circumstance which could have contributed to the occurrence of the incident.

4. Safety recommendations

Learning from the technical investigation, the IC makes the following safety recommendations:

BA2006-002_1: TSB recommends that AEROFLEX Ltd. should review the pagination of WORK SUMMARY SHEET so that the subsequently taken out or added pages could be clearly traced in each case.

BA2006-002_2: TSB recommends that MALEV Plc. should introduce Engineering Order no. 767-21-0030 - which was prepared following the issue of Service Letter no. 767-SL-21-064-B of Boeing factory - and consider its disposure as well as the replacement of P/N 2117388-13 type Cabin Pressure Controller with P/N 2117388-15 type.

Budapest, 15th January 2007.

Sándor Sipos	**János Horváth**
IC Head	IC Member