

**В737-800, EI-CSG АГААРЫН ХӨЛГИЙН  
БҮХЭЭГИЙН ДАРАЛТ БАГАССАН  
НОЦТОЙ ЗӨРЧИЛ,  
ФРАНЦ УЛС**

2016 оны 6-р сарын 08

**B737-800, EI-CSG SERIOUS INCIDENT  
“CABIN DEPRESSURIZATION”**

France

08 Jun. 2016

**НОЦТОЙ ЗӨРЧЛИЙГ ШИНЖЛЭН  
ШАЛГАСАН ТАЙЛАН**

2018 оны 08-р сарын 17

**FINAL REPORT OF SERIOUS INCIDENT  
INVESTIGATION**

17.Aug.2018



**ЗАМ, ТЭЭВРИЙН ХӨГЖЛИЙН ЯАМ  
НИСЛЭГ-ТЕХНИКИЙН ОСОЛ, ЗӨРЧЛИЙГ ШИНЖЛЭН ШАЛГАХ АЛБА  
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## Өмнөх үг

Энэхүү аюулгүй ажиллагааны шинжлэн шалгах ажиллагаа нь зөвхөн бодит үнэнийг тодорхойлох зорилготой бөгөөд Шинжлэн шалгах албаны тайлан нь уг тохиолдлын нөхцөл байдал болон байж болох шалтгаануудыг тогтооход оршино.

Олон улсын иргэний нисэхийн Конвенцийн Хавсралт 13, Монгол Улсын Иргэний нисэхийн тухай хуулийн [9-р бүлэг] болон Иргэний Нисэхийн Дүрэм 203-т заасны дагуу, шинжлэн шалгах ажиллагаа нь ямар ч тохиолдолд хэн нэгнийг буруутгах, хариуцлага тооцоход чиглэгдэхгүй. Шинжлэн шалгах ажиллагаа нь хэн нэгний гэм бурууг тогтоох, хариуцлага тооцох хууль хяналт, захиргааны арга хэмжээнээс ангид бие даасан, хараат бус байна. Шинжлэн шалгах ажиллагаа болон тайлангийн гол зорилго нь осол, зөрчлийг давтагдахаас урьдчилан сэргийлэхэд оршино.

Тайлангийн ишлэлийг ашиглахдаа эх үүсвэр нь тодорхой, агуулгыг гуйвуулахгүйгээр хэвлэн нийтэлж болох бөгөөд гутаан доромжлох, төөрөлдүүлэх зорилгоор ашиглахыг хориглоно.

## Foreword

This safety investigation is exclusively of a technical nature and the Final Report reflects the determination of the AAIB regarding the circumstance of its occurrence and its probable causes.

In accordance with the provisions of Annex 13 to the Convention on International Civil Aviation, Civil Aviation Law of Mongolia [Chapter 9] and MCAR's 203.12, safety investigations are in no case concerned with apportioning blame or liability. They are independent of, separate from and without prejudice to any judicial or administrative proceedings to apportion blame or liability. The sole objective of this safety investigation and Final Report is the prevention of accidents and incidents.

Extracts from this Report may be published providing that the source is acknowledged, the material is accurately reproduced and that it is not used in derogatory or misleading context.

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## Abbreviations

AAIB	- Air Accident Investigation Bureau of Mongolia
AAIU	- Air Accident Investigation Unit of Ireland
AF	- Airframe
ALT	- Altitude
ALTN	- Alternate
AMM	- Aircraft maintenance manual
AV	- Avionic
A/C	- Aircraft
BEA	- Le Bureau d'Enquêtes et d'Analyses
CPC	- Cabin pressure controller
CRS	- Certificate of release to service
CVR	- Cockpit voice recorder
CTR	- Controller
EASA	- European aviation safety agency
EL	- Electric
EMM	- Engine maintenance manual
FL	- Flight level
FLT	- Flight
DC	- Direct current
DCPC	- Digital cabin pressure controller
DDG	- Dispatch deviation guide
DFDAU	- Digital flight data acquisition unit
FAR	- Federal Aviation Regulation
FIM	- Fault isolation manual
ICAO	- International civil aviation organization
IPC	- Illustrated parts catalog
IR	- Instrument rating
HPWS	- High pressure water separator
LH	- Left hand
LRU	- Line replaceable unit
MEL	- Minimum equipment list
MAN	- Manual
MCAA	- Mongolian Civil Aviation Authority
MCAR	- Mongolian Civil Aviation Regulation
MIAT	- MIAT Mongolian Airlines
MLB	- Maintenance logbook
MME	- Maintenance Management Exposition
MOE	- Maintenance organization exposition
MPD	- Maintenance planning document
MRBR	- Maintenance review board report
MTBUR	- Mean time between unscheduled removal
NTSB	- National transport safety bureau
NVM	- Non-volatile memory
P/N	- Part number

PP	- Powerplant
QRH	- Quick reference handbook
RH	- Right hand
RTN	- Return
S/N	- Serial number
SL	- Service letter
SLFPM	- Sea level feet per minute
TLB	- Technical logbook
VDC	- Voltage DC
VHF	- Very high frequency
USA	- United States of America
UTC	- Coordinated universal time

## Executive summary

The B737-800 aircraft with registration EI-CSG, operated by MIAT, diverted from flight route and executed emergency descent & landing at Toulouse airport, France, due to the situation of cabin altitude uncontrollable that occurred at UTC 18:35 on 08 Jun 2016.

In accordance with the provision of section 2.3 "Auto fail or unscheduled pressurization change" of QRH manual, flight crew must don oxygen masks when cabin altitude is uncontrollable, and events requiring the emergency use of oxygen masks by the flight crew are considered as serious incident as specified in the Attachment C of Chicago Convention's Annex 13.

The French air accident investigation organization, BEA, has delegated the whole part of the conducting of investigation to the AAIB of Mongolia. Therefore the team, appointed by the Director of the AAIB of Mongolia in accordance with Civil aviation law of Mongolia, article 5.1 of Annex 13 of Chicago convention and civil aviation rule no.203, approved by Minister of Road, transport, construction and urban development, conducted the investigation.

Investigation authorities of the State of design and manufacturer, USA, and State of registry, Ireland, have been notified on this serious incident in accordance with provisions of the Annex 13 of Chicago Convention. Investigation organisations of State of registry, AAIU and USA's NTSB have appointed their accredited representatives. A copy of draft final report was sent to the above mentioned states inviting their significant and substantiated comments on the report. AAIU and BEA informed that they have no comments.

### 1. Factual information

#### 1.1. History of the flight

The EI-CSG aircraft departed from Prague's PRC airport to Seville, Spain, on 08 Jun 2016 at 16:44 UTC. During climb at flight altitude 11,200 feet, when "Auto fail" and "Master caution" lights illuminated, cabin pressurisation system "ALTN" mode was selected according to the instruction QRH 2.3. The "Auto Fail" light extinguished and crew continued the flight. The "Auto fail" light illuminated again at a distance of approximately 80km to Toulouse, France at UTC 18:10:30, at the flight level of 35,000 feet. Therefore cabin pressurisation system "MAN" mode was selected in accordance with the instruction set in QRH 2.3. However cabin pressure reduced, cabin altitude reached to 10,010 feet and cabin altitude warning activated, flight crew assumed that cabin pressure became uncontrollable and performed emergency descent and landing at the airport of Toulouse, France at 18:34:30 UTC following the instructions set in ORH 2.3.



Figure 1. Flight trajectory

1.2. Injuries to persons

injuries	Crew	Passengers	Others	Total
Fatal	-	-	-	-
Serious	-	-	-	-
Minor	-	-	-	-
None	11	183	-	194

Table 1. Injuries to persons

1.3. Damage to aircraft

None

1.4. Other damage

None

## 1.5. Personnel information

### 1.5.1. Captain

Captain is a citizen of Mongolia, 44 years old, male. He graduated "Sasovo" flight school of Soviet Union with the degree of commercial pilot in 1992 and the Aeronautical Institute of Riga, Latvia as flight-navigator in 1994. He had flight experience on An-2, MI-8 and Saab-340.

Captain completed a B737-800 type rating training course at Boeing Training Center located in USA from 04 Apr to 06 May 2011 and became co-pilot of B737-800 on 04 Aug 2011. He completed captain transition training for 04-20 Apr 2014 in the Cockpit4u training center, Germany and became B737-800 captain in June 2014. Total flight time is 9,288 hours, including 4,946 hours as captain, 4,773 hours on B737-800 aircraft, and 1,904 hours as captain of B737-800.

A transport pilot license with rating "B737-800/IR" was valid until 20 Jun 2016 and the Class 1 medical certificate was valid until 01 Oct 2016.

### 1.5.2. Co-pilot

The co-pilot is a citizen of Mongolia, 34 years old, male. He completed on 20 Mar 2009 a six-month Commercial pilot course of the Scandinavian Aviation Academy, certified in accordance with the FAR-141 (<https://www.bfsaa.se/en/modular-courses/cpl-me-ir>). He has the flight experience on Saab340 as co-pilot.

He has completed B737-800 type training at Boeing training center, USA from 21 Feb to 06 Mar 2012 and became co-pilot of B737-800 in June 2012. He has flown 3,403 hours on B737-800 from total 5,097 hours of flight.

His commercial pilot license with rating "B737-800 / IR" was valid until 02 May 2017 and the Class 1 medical certificate was valid until 03 Aug 2016.

### 1.5.3. Certifying staff

A maintenance team consisting 5 engineers being settled in Prague, Czech Republic, have performed maintenance during the wet lease operation. Three engineers performed maintenance on EI-CSG aircraft during 07-08 Jun 2016.

Performed maintenance actions	License category	Rating and expiration date	Internal authorization issued by MIAT
Preflight check before flights PRG-KGS, KGS-PRG, PRG-DBV on 08 Jun 2016 Cabin pressurization check at KGS	Turbine aircraft	B737-800 AF, PP, AV, EL 05 Oct 2016	"A" CRS up to including Preflight check
Preflight check before flights DBV-PRG, PRG-SVQ on 08 Jun 2016	Turbine aircraft	B737-800 AF, PP, AV, EL 14 Aug 2016	"B2" CRS for line maintenance
Daily check on 07 Jun 2016, Preflight check before flight TLS-PRG on 08 Jun 2016	Turbine aircraft	B737-800 AF, PP, AV, EL 27 Oct 2016	"B1" & "B2" CRS for line maintenance

Table 2. Information of engineers performed checks on 2016.06.07-08

The engineer, performed cabin pressure system after PRG-KGS route flight, has the "A" category certifying staff authorization issued by MIAT. The scope of the "A" category certification authorisation set in the provision of the 3.4.2 a) of the MME does not include checking of the cabin pressurisation system. In the "Competence Assessment of Personal" assessment, done on 17 Jul 2016, noted that this engineer's English language level did not meet the requirements of "A" category certifying staff.

The AAIB have issued the safety recommendation on 29 Apr 2016, indicating that category and rating of the license issued by MCAA are not comply with the category and rating specified in the MCAR- 66.

## 1.6. Aircraft information

### 1.6.1. Airframe

The aircraft with MSN 29922, was manufactured in 2000. MIAT is operating since Apr 2008 under an operating lease agreement with CIT International.

The aircraft is registered in Ireland. The certificate of airworthiness, issued by the competent authority of Ireland is valid until 27 Jun 2017. The Irish Civil Aviation Authority has delegated the aircraft airworthiness and some other operational controls to the MCAA, in accordance with the Delegation agreement Rev 1, signed in 2011.

As of 08 Jun 2016, the aircraft has flown 44,341 hours and 25,873 cycles.

### 1.6.2. Engine

The aircraft is powered by two CFM56-7B engines, with the P/N CFM56-7B24, manufactured by CFM International SA.

Engine	#1	#2
Model	CFM56-7B	
Part number	CFM56-7B24	
Manufacturer Serial number	890420	890421
Date of Manufacture	2003	2003
Total flight hours	35,959	35,959
Total cycle	19,889	19,889
Time since last shop visit	4,525	4,525
Cycle since last shop visit	2,200	2,200

Table 3. Engine general information

### 1.6.3. Cabin pressurization system

The cabin pressure control system controls the rate that the air flows out of the cabin. These are the components of the cabin pressure control system:

- Cabin pressure control module
- Two digital cabin pressure controllers (CPC)
- Outflow valve
- Overboard exhaust valve.

Cabin pressure control system has 3 modes: AUTO (2-channel automatic operation), ALTN (1 channel auto-operation) and MAN (hand control). Each CPC has its own systems interface and valve motor system. This gives the AUTO mode of control a dual redundant architecture. Only one CPC controls the outflow valve at any time. The other CPC is a backup. The active controller changes for every flight or when there is an autofail event.

The cabin pressure control module has these controls and indications:

- Mode selector
- LAND ALT (Landing altitude) selector with display
- FLT ALT (flight altitude) selector with display
- Manual mode toggle switch
- Aft outflow valve position indicator.

These are the four system status lights above the control panel:

- AUTO FAIL (system failure)
- OFF SCHED DESCENT (deviation from flight plan)
- ALTN (operational mode)
- MANUAL (operational mode).

These are the indications and controls on the cabin altitude panel:

- Cabin altitude/differential pressure indicator
- Cabin rate of climb indicator
- ALT HORN CUTOUT switch.

These things cause the auto fail function:

- Power loss
- Cabin altitude rate of change is too high (>2,000 slfpm)
- Cabin altitude is too high (>15,800 ft)
- Wiring failures
- Outflow valve component failures
- CPC failures
- Cabin differential pressure is too high (>8.75 psi).

The system automatically changes pressurization control to the backup controller if the active controller fails. If the system is in the AUTO mode when an auto fail event occurs, these lights come on:

- Amber AUTO FAIL light
- MASTER CAUTION and AIR COND annunciator lights
- Green ALTN light.

The ALTN light shows that the backup system is active. The AUTO FAIL light goes off when you select the ALTN position on the mode selector.

These are the indications when both CPC systems fail:

- The AUTO FAIL and MASTER CAUTION lights come on
- The FLT ALT and LAND ALT displays show five dashes (-----).

If both CPCs fail, the ALTN light does not come on. This indicates that the system cannot transfer control to an operative automatic controller.

If the two controllers are inoperative or it is impossible to automatically control the cabin pressure, cabin pressure can be controlled manually in MAN mode by changing of outflow valve position via a toggle switch with 3 positions: Close-Neutral-Open.

The outflow valve gearbox provides three driving paths: Two paths are provided by activation of one of the brushless DC motors during automatic mode operation of the CPCs. The third path is provided by the brush-type DC motor during manual mode operation of the outflow valve.

When cabin pressure system controller is in Autofail or inactive, the coupled motor be locked through the electromechanical brake.

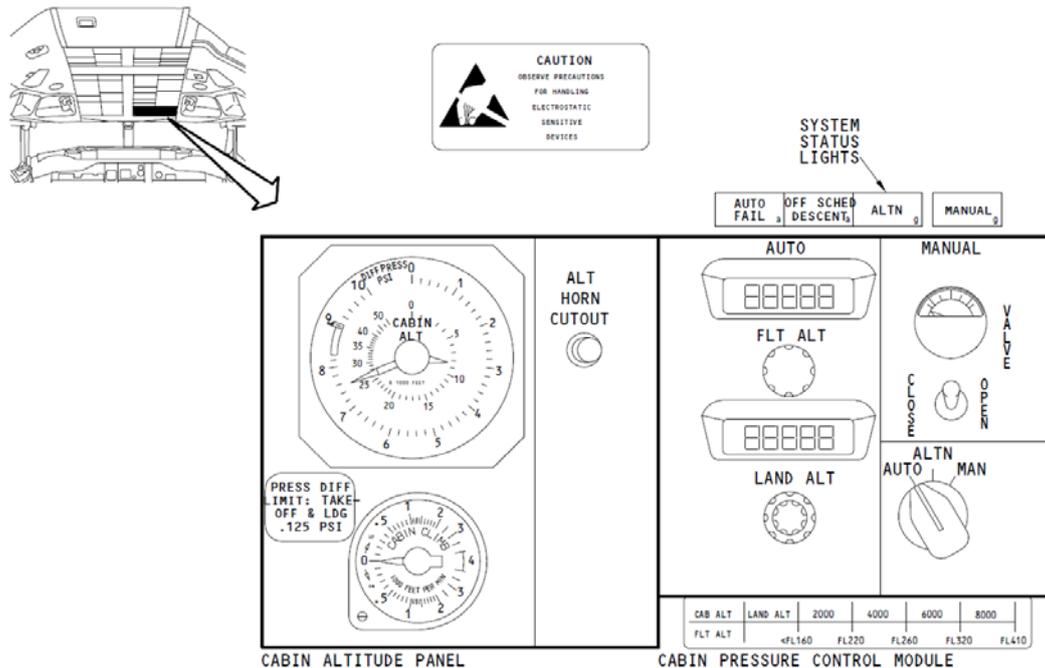


Figure 2. Cabin pressure control module and cabin alt panel

Part description	Controller #1	Controller #2	Cabin Pressure Selector Panel	Outflow valve	Overboard Exhaust valve
Part number	7121-19971-01AC	7121-19971-01AC	7123-19973-03AB	4063-19972-01AB	20798-01
Manufacturer Serial number	0011913	0319659	99107114	9910551	9973472
Date of Last shop repair	2012.10.11	2015.03.13	2013.02.11		-
Date of installation	2012.12.13	2015.03.26	2013.05.08	2000.08.23	2000
Time since last shop visit	7,467	2,834	6,490	21,686	-
Cycle since last shop visit	3,346	1,421	2,998	10,169	-

Table 4. Components of cabin pressurization system

The cabin altitude warning switch, S128, warns the flight crew when cabin altitude is critical. The switch closes when the cabin altitude is between 9,000 and 11,000 feet.

When the cabin altitude warning switch closes, these things occur:

- The switch grounds the horn circuit which energizes the system
- The aural warning module makes an intermittent beep alarm.
- The red CABIN ALTITUDE indicator lights on the captain's instrument panel P1-3 and the first officer's instrument panel P3-1 will come on.

Boeing SB 737-21-1165 improving the reliability of the cabin altitude warning system by installation of a redundant switch of the cabin altitude pressure, replacing the aural warning module (AWM) with a new or reworked AWM has not yet embodied on the aircraft. Design state USA have issued AD 2012-19-11, 2015-16-01 and 2015-21-11, related to the SB 737-21-1165 bulletin. SB 737-31A1332 installing “Cabin altitude” red warning light has been embodied on 17 Nov 2011.

Passenger oxygen masks deploy electrically one of these ways:

- Manually by the crew with a guarded toggle switch on the oxygen system control panel (P5)
- Automatically by operation of a pressure switch (14000 feet cabin altitude).

#### 1.6.4. Boeing info on DCPC P/N 7121-19971-01XX

The controllers with following part numbers are available to use for the cabin pressure systems of the B737-800 aircraft:

Component	Boeing SCD P/N	Nord-Micro P/N	
Controller	10-62231-2	7121-19971-01AA	
	10-62231-12	7121-19971-01AB	
	10-62231-22	7121-19971-01AC	
	10-62231-32	7121-19971-01BA	
	10-62231-42		21933-01AA
			21933-01AB
			21933-01AC
10-62231- 52		21933-01AD	

Table 5. P/Ns of DCPC

DCPC with P/N 7121-19971-01AC were installed on the EI-CSG aircraft. Boeing issued several documents on DCPC with this P/N described briefly below.

Document no. and date	Brief content
<p>737-SL-21-087</p> <p>Digital cabin pressure controller – P/N 7121-19971-01XX On-wing service life</p> <p>15 February 2010</p>	<p>As the early digital cabin pressure controllers remain in service, some operators have noticed increased removal rates. Repair information suggests that failure of the integrated circuits (IC) used for storage of the non-volatile memory (NVM) are a common issue. Analysis suggests that the maximum read/write cycles to the NVM can be exceeded as a consequence of a very high number of fault codes entered into the controller NVM. Failure of the NVM may prevent proper system operation as the NVM stores data required for proper system calibration, flight operation, and fault recording.</p> <p>CPC removals for fault code (FC) 46 (NVM READ WRITE FAIL) or FC 47 (NVM RANGE FAIL) as the reason for removal may require NVM IC replacement. In some cases, access to NVM information may not be possible due the failure. Analysis has determined that the life limit of the IC can be exceeded by fault code writes to NVM. These writes to the NVM can be from issues other than those within the pressurization control system, such as airplane level issues external to the system – example: FC 30 (LO INFL/HI LEAKG).</p> <p>Boeing and Nord-Micro developed the 21933-01XX series CPC due to parts obsolescence (see the reference a) service letter for more details). The latest series of controllers include state of the art technology which allows more read/write cycles to memory locations.</p> <p>Boeing recommends operators who experience CPC removals as a result of FC 46, FC 47, or other reasons related to the NVM, make sure that the controllers, when repaired, are updated to P/N 7121-19971-01AC configuration. In addition, Boeing recommends operators address those concerns that result in repeated faults written to the CPC NVM that are aircraft level issues. Examples of these faults are:  FC 30 (LO INFL/HI LEAKG) – May be caused by bleed pressure too low, pack flow too low, or excessive airplane leakage  FC 31 (ACFT RATE HI) – The airplane may have been flown beyond the capability of the system.  Nuisance faults that have been corrected with software or other changes as outlined in the reference a) service letter.</p> <p>Alternatively, operators may consider replacing the subject CPC with the latest P/N 21933-01AC controller to obtain improved on-wing life.</p>
<p>737-SL-21-044-D</p> <p>Digital cabin pressure system – Cabin pressure excursions due to EMI</p> <p>18 July 2011</p>	<p>This service letter informs operators of abnormal cabin pressure excursions usually at low altitudes during climb and descent experienced on 737 airplanes with the digital cabin pressure control system (DCPCS). The anomaly has been identified as EMI-induced with the digital cabin pressure controller being affected by radio frequency (RF) radiation from the traffic collision avoidance system (TCAS) transponder system. An interim fix for the anomaly has been identified to eliminate the cabin pressure excursions and a permanent modification to the</p>

	DCPCS controller was made with the new Design and P/N roll to P/N 21933-01XX controller.
737-SL-21-074-E  Component interchangeability – Digital cabin pressurization system  31 March 2015	Numerous changes have been accomplished on the primary components used on the 737 digital cabin pressurization system – the P5-6 cabin pressure selector panel, the M1653 and M1654 cabin pressure controllers and the V48 cabin pressure outflow valve. This service letter provides information and restrictions in regard to interchangeability of these components on all 737 models that use the digital cabin pressure control system.  Suggested operator action: ... <b>Boeing recommends operators use the most current components available.</b> Operators may wish to incorporate the respective Nord-Micro or Hamilton Sundstrand component service bulletins into their components to have the latest configurations in their fleet.

Table 6. DCPC modifications

DCPC P/N 7121-19971-01AC can be replaced by DCPC P/N 21933-01AA, AB, AC and A4 as specified in the B737-800 AIPC 21-31-01.

Part number	Quantity of manufactured controller	MTBUR /as of 2016/
7121-19971-01XX	4,882	14,000FH
21933-01XX	9,031	59,340FH

Table 7. Data provided by DCPC manufacturer Nord-Micro

### 1.7. Technical operation

MIAT holds following certificates of approved maintenance organisation:

- EASA No.145.0293 valid until 23 Mar 2017.
- No.AMO/01 issued by the MCAA valid until 03 Feb 2017.

Maintenance records show that MIAT performed EI-CSG aircraft maintenance under the scope of certificate AMO/01 issued in accordance with MCAR-145.

#### 1.7.1. Maintenance program

Appendix 1, VIII-Maintenance of Bis83 agreement says “Leased aircraft, its engines and equipment, will be maintained in accordance with the State of Registration Authority approved maintenance program with the approval of the State of the Operator authority”. The amendment of the aircraft maintenance program, issue 10, revision 02 dated 15 Feb 2016 approved by Irish Civil Aviation Authority on 31 Mar 2016 and by the MCAA on 23 Mar 2016.

It is stated on the aircraft maintenance program that it was developed on the basis of MRBR, MPD and EMM. Operational check of outflow valve and overboard exhaust valve are performed every 12,000FH and 9,000FH respectively. MRBR and MPD do not have a requirement to periodically check the DCPC.

## 1.7.2. Pre incident maintenance

Last “C” check was performed by MIAT on 04 Nov 2015 in Ulaanbaatar (43,277FH / 25,261FC). “A” check was performed in Czech Republic on 24 Apr 2016 (44,193FH / 25,801FC) .

On Monday, 07 Jun 2016, the Daily check was accomplished according to the “B737-Daily check” task card and 4 findings were rectified as recorded in the MLB S0314417-S0314420. During the period 13 Apr-07 Jun 2016, there have not been recorded any defects associated with the aircraft cabin pressurisation system in the TLB and MLB.

The pre-flight check performed before PRG-SVQ flight was certified by signing on the TLB.

## 1.7.3. Pre incident technical condition

On 08 Jun, EI-CSG aircraft was operated in 4 flights. On the PRG-KGS flight, the “Auto Fail” light illuminated and crew selected to the MAN mode. The aircraft has been landed at KGS at UTC 05:25 and #2 controller showed fault code FC014 when onboard engineer performed a check according to instructions specified in FIM Task 21-31, Task 801. The aircraft started the next flight at UTC 06:40 after the check.

Flight route	Reported defects	Action taken
PRG-KGS	TLB T0924889: At FL350 during crz PRG-KGS, Auto Fail light illuminated. According to QRH flt crew selected pressurization mode selector to manual. Performed approach and ldg with <b>manual</b> selection. Please check.	Performed FIM Task 21-31 Task 801. Shows FC014 controller #2. After bite test system check is ok.
KGS-PRG	No	
PRG-DBV	No	
DBV-PRG	No	

Table 8. Flights before incident

## 1.7.4. Post incident inspection

Date / Flight route	Reported defects	Action taken
2016.06.08 PRG-SVQ	TLB T0924893: During climb from PRG app 16500 ft “Auto Fail” light comes on with master caution “Air cond”. According QRH 2.3 “Auto Fail” checklist, pressurization mode selector set to “ALTN” and auto fail light extinguished. Cabin altitude was controllable. In cruise at 35000 ft “Auto Fail” light comes “ON” again. According same checklist 2.3, pressurization mode selector set to “MAN”. Cabin altitude was uncontrollable, continued increase and horn comes. did emergency descent, landed in Toulouse, France.	During bite test acc. FIM 21-31 Task 801 pushed On/Off button on the #1 DCPC display still blank (like no pwr). On the #2 DCPC bite fault history shows code 014, CPC-CPC wiring maint msg. Pulled C/B P6-4 F3 “pressurization control auto 1” and rerailed DCPC #1 and bite shows “contrlr LRU fault” code 032 maint msg. After ground test bite procedure DCPC #1 and DCPC #2 shows “System ok”.  TLB T0924896: A/C dispatched acc. MEL 21-14-03 pg 21-8. Performed “M” and “O” item acc. DDG.
TLS-PRG	No	

Table 9. Defects recorded in TLB

It was noted in the MIAT incident report that “Auto Fail” illuminated again during the technical flight TLS-PRG.

Findings	Date	Replaced component	Installed component
Fault code 032, 042, 030 on #1 controller	2016.06.09	DCPC P/N 7121-19971-1AC, S/N 0011913	P/N 7121-19971-01AC, S/N 9960402
Fault code 014, 030 on #2 controller	2016.06.10	DCPC P/N 7121-19971-1AC, S/N 0319659	P/N 21933-01AC, S/N 1260354
Fault code 030 on #1 controller	2016.06.09	Flex Hose which connects HPWS mix muff with HPWS condenser found ruptured. The hose was replaced	
7 ea structure drain valves do not close	2016.06.10	7 ea structure drain valves were replaced	

Table 10. Maintenance actions done on 2016.06.09-10

The aircraft has released to scheduled service on 10 Jun but the cabin pressurisation system malfunction reported again on 17 Jun 2016.

Date/ flight route	Reported defects	Action taken
2016.06.17 DEB-ZTH	TLB T 0928153: During climb from DEB @ flight level 24000' and 27000' 2 times and @ cruise flight level 33000' 4 times cabin climb rate reaches 3000-4000 feet per minute. @ 11:57 UTC Autofail light comes on then requested on QRH we put alternate mode then landed normally. Check bleed A.	On the #1 DCPC shows “fault”. During the bite test FIM 21-31 Task 801 “Contrlr LRU fault” shows. Code 051 maint msg. After ground test DCPC #1 shows “system ok”. Auto Fail goes off.
ZTH-BUD	TLB T0928155: Same as previous 6 times sudden increase of cabin climb rate that reaches 3000'-4000' feet per minute then auto fail light come on. Put it in alternate mode, landed normally.	Performed DCPC replacement in acc. With AMM 21-31-01.  TLB T0928156: Replaced outflow valve assy in acc. With AMM 21-31-03.

Table 11. Defects recorded in TLB on 2016.06.17

Components replaced in relation with above defects listed in Table 12.

Date	Removed part	Installed part
2016.06.18	DCPC P/N 7121-19971-01AC, S/N 9960402	P/N 7121-19971-01AC, S/N 9711968
2016.06.18	OFV P/N 4063-19972-01AB, S/N 9910551	P/N 4063-19972-02AB, S/N 9810529
2016.06.26	Cabin pressure control module P/N 7123-19973-03AB, S/N 99107114	P/N 7123-19973-03AB, S/N 98123333
2016.07.05	Wiring and connector's pin, sockets checks were performed. #20 socket of D10726 connector was replaced due to suspected loose.	

Table 12. Maintenance actions taken to rectify defects reported on 2016.06.17

28 VDC electric power is supplied to the control module through #16 socket of D10724 and # 20 socket of D10726 connector. Although control module (Fault code 107) is listed in possible cause of "Auto fail" light illumination specified in FIM 21-31 Task 827,

but Fault code 107NVM was not found during the check of memories of the replaced three controllers. In addition, the # 20 socket is not listed among the sockets, specified in FIM 21-31 Task 804, required to be checked in case "Auto Fail" light illuminated due to wiring defects. Therefore the condition of # 20 socket of D10726 connector might not have affected to the failure of the cabin pressure drop, occurred on 08 Jun 2016.

#### 1.7.5. Component teardown reports

д/д	Component information	Date of removal	Removal reason	Shop findings
1	Controller, P/N 7121-19971-01AC S/N 0011913	2016.06.09	Fault code 030, 032, 042	Removal reason <b>confirmed</b> . IC705 and copper foil tape must be replaced.
2	Controller P/N 7121-19971-01AC S/N 0319659	2016.06.10	Failure code 014	Removal reason confirmed. FL1 to FL4 and copper foil tape must be replaced.
3	Controller P/N 7121-19971-01AC S/N 9960402	2016.06.18	Shows controller fault. Fault code 051, 005	Removal reason <b>confirmed</b> . IC705 must be replaced due to fault codes and copper foil must be replaced.
4	Outflow valve P/N 4063-19972-01AB S/N 9910551	2016.06.18	Cabin rate fluctuation occurred	Reason for removal confirmed: <b>No</b> , Initial test can not duplicate the snag.
5	Selector panel P/N 7123-19973-03AB S/N 99107114	2016.06.26	Auto fail light come on	Initial test fail? No Reason for removal confirmed: <b>No</b>

Хүснэгт 13. Shop findings of removed components

Fault code "5 High cab rate change" was recorded in the NVM Fault buffer # 12 of the controller with P/N 7121-19971-01, S/N 99604028. FIM 21-31 Task 818 "Hi Cabin Altitude Rate Change" says that the outflow valve or controller could be the possible cause. Cabin pressurisation defect reported on 17 Jun 2016 could be caused by the internal defect of the controller with P/N 7121-19971-01A, S/N 9960402. And the defect reported on 17 Jun 2016 is not likely to be related to the failure of 08 Jun 2016.

#### 1.8. Flight operation

The MCAA has issued Air Operator Certificate No.AT-003 on 14 May 2014 which was valid until 04 Sep 2017. According to the wet lease agreement, concluded with the Travel service group of the Czech Republic, MIAT has being operated flights by EI-CSG aircraft with 5 flight crew, accommodated at Prague, Czech Republic, as outstation of operation commencing from 13 Apr 2016.

No any amendment was done into the Air Operator Certificate in connection with the Wet lease agreement. During the leasing period, in average, 3 flights have been performed daily.

On the 08 Jun 2016, EI-CSG aircraft was operated in the following destinations:

- PRG-KGS-PRG
- PRG-DBV-PRG
- PRG-TLS-PRG.

“AUTO FAIL or the Unscheduled Pressurization Change” checklist of the B737-800 QRH says “AUTO FAIL light is **illuminated or** cabin altitude is **uncontrollable**: Pressurization mode selector . . . . .MAN” . Outflow valve switch should be moved to open or close as needed to control cabin altitude and rate. If cabin altitude is uncontrollable, flight crew should don oxygen mask and activate passenger oxygen mask and follow instructions for Emergency descent checklist.

1.9. Meteorological information

Not related

1.10. Communications

The BEA provided the voice communication records between flight crew and air traffic controllers as well as flight path information (Figure 1).

1.11. Aerodrome

Not related

1.12. Recorder data

1.12.1. Flight data readout

The Honeywell FDR with P/N 980-4700-042, S/N 5887 and DFDAU P/N 2233000-815-1, S/N 01980 were installed on the aircraft. The flight data concerning 05-08 Jun flights, obtained from DFDAU was checked in the AAIB.

Date	Flight route, OFF-ON Block, T/O –LDG time	Time (UTC)	Flight altitude (ft)	Warning	Remarks
2016.06.08	PRG-KGS 02:45-05:25 02:54-05:18	4:00:20-4:00:32	35000	Master caution	Both pack on
		4:05:20	35004	Master caution	
		4:40:00	34997	Master caution	
		4:40:04	34995	Master caution	
		4:48:24-4:49:00	33966	<b>Cabin altitude warning</b>	
2016.06.08	KGS-PRG 06:40-09:43 06:52-09:33	6:58:11	16975	Master caution	Both pack on
		7:13:26	33998	Master caution	
		8:55:42	34000	Master caution	
2016.06.08	PRG-DBV 10:19-12:08 10:45-12:02	11:38:10	31653	Master caution	
2016.06.08	PRG-SVQ (TLS) 16:20-18:45 16:43-18:35	16:47:46-16:47:54	11174-11614	Master caution	Lat 50.05198, Long 13.84002
		18:10:30-18:11:45	34998-35002	Master caution	
		18:13:57-18:14:37	34995-35006	Cabin altitude warning	Lat 44.32188, Long 1.793517
2016.06.08		18:14:37-18:14:49	35006-34977	Master caution & <b>Cabin altitude warning</b>	
		18:14:49-18:16:41	34977-27931	<b>Cabin altitude warning</b>	
		18:28:05	3491	Master caution	
2016.06.09	TLS-PRG 23:30-01:39 23:41-01:30	0:01:40-0:01:48	34018	Master caution	
		0:06:40-0:06:44	34013	Master caution	
		0:55:08	33995	Master caution	

Table 14. Flight data readout

1.12.2. Cockpit Voice Recorder readout

The Honeywell CVR with P/N 980-6022-001, S/N CVR120-13601 was installed on the aircraft. The CVR stores the records of last 120 minutes of flight.

After emergency landing at Toulouse in France, the CVR has not been switched off and then technical flight lasted approximately 1 hour 50 minutes from Toulouse to Prague

was done. Due to the situation that the airlines has not followed the requirement, concerning the storage of the records of the flight data recorder information after the incident, as stated below in the MCAR-121, it was impossible to obtain CVR records of the flight.

**121.385. Operation of the Flight recording devices /FDR, CVR/ and storage of them after accident and incident.**

(a) It is prohibited to switch off the recording devices during the flight.

(b) If the Aircraft has subjected in the accident or incident the Air Operator Certificate holder shall, for the purpose of preservation the data, recorded in, switch off the devices and storage up to 60 days or for a longer period of time upon request of the competent authority.

# B737-800 EI-CSG

Date: 2016.06.08

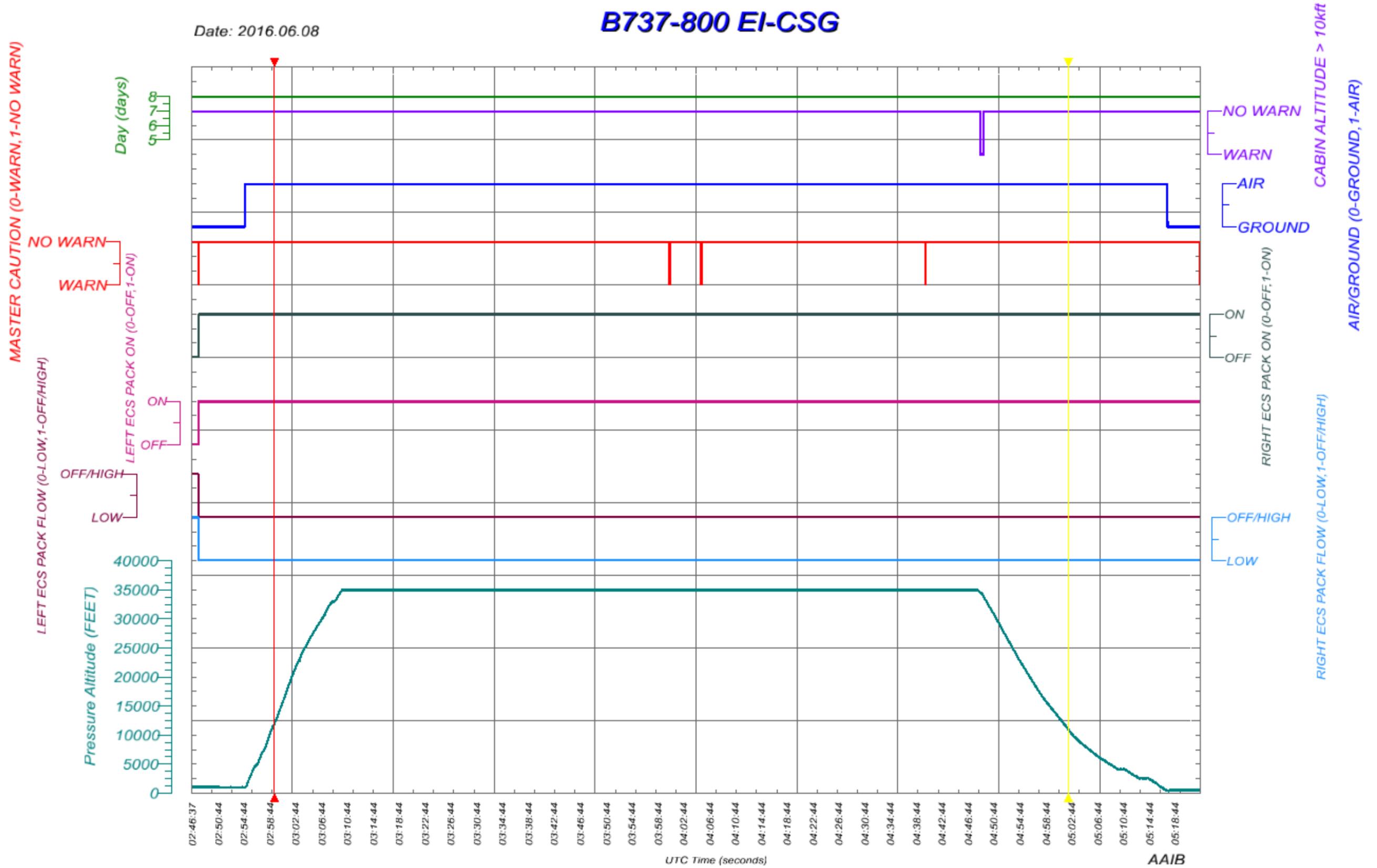


Figure 3. First flight of 2016.06.08 (PRG-KGS)

# B737-800 EI-CSG

Date: 2016.06.08

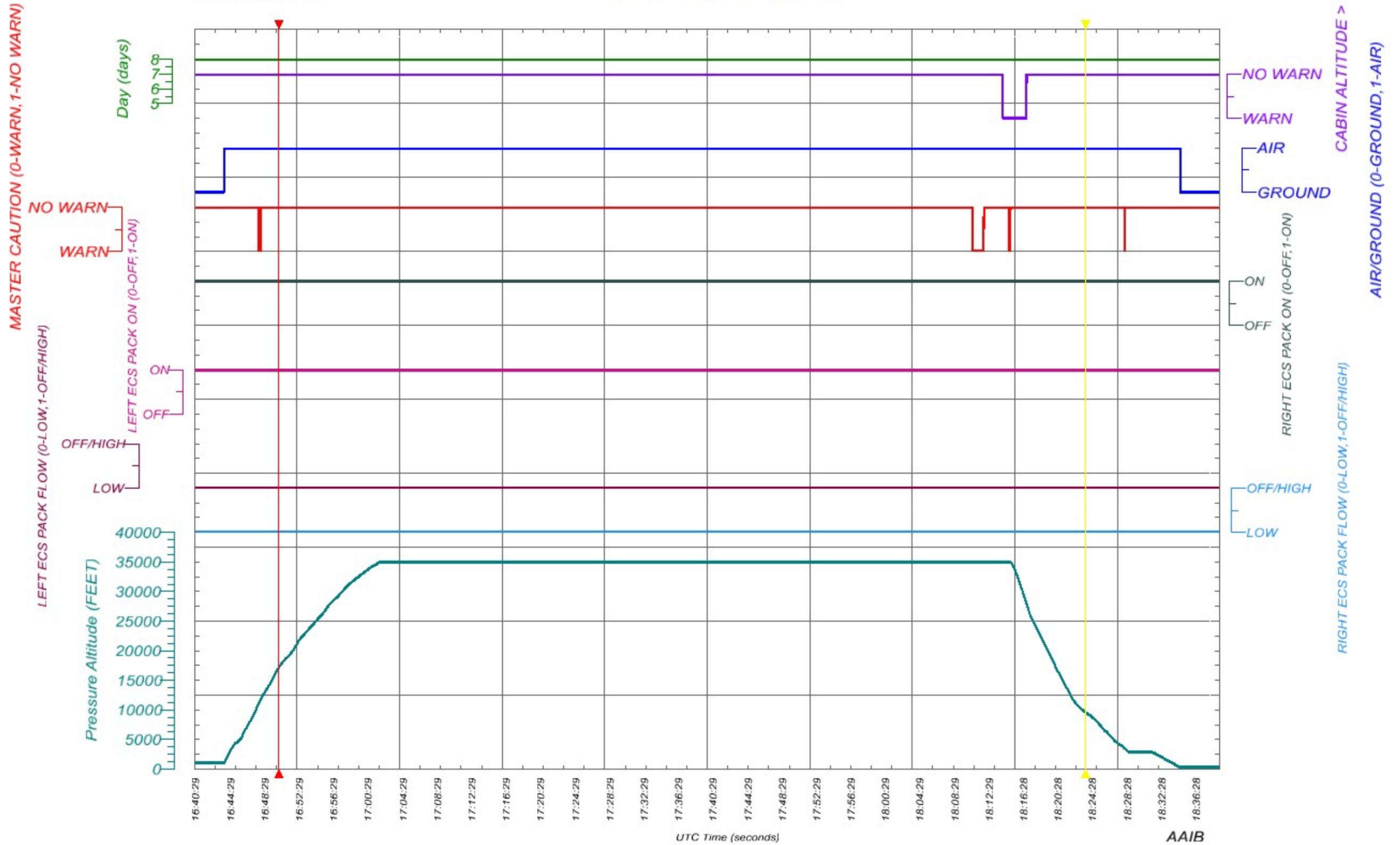


Figure 4. Flight PRG-SVQ (TLS) dated 2016.06.08

MASTER CAUTION (0-WARN, 1-NO WARN)

RIGHT IGN (#2) CMD ON #1 (0-OFF; 1-ON)

LEFT ENG N1 TACHOMETER (%RPM)

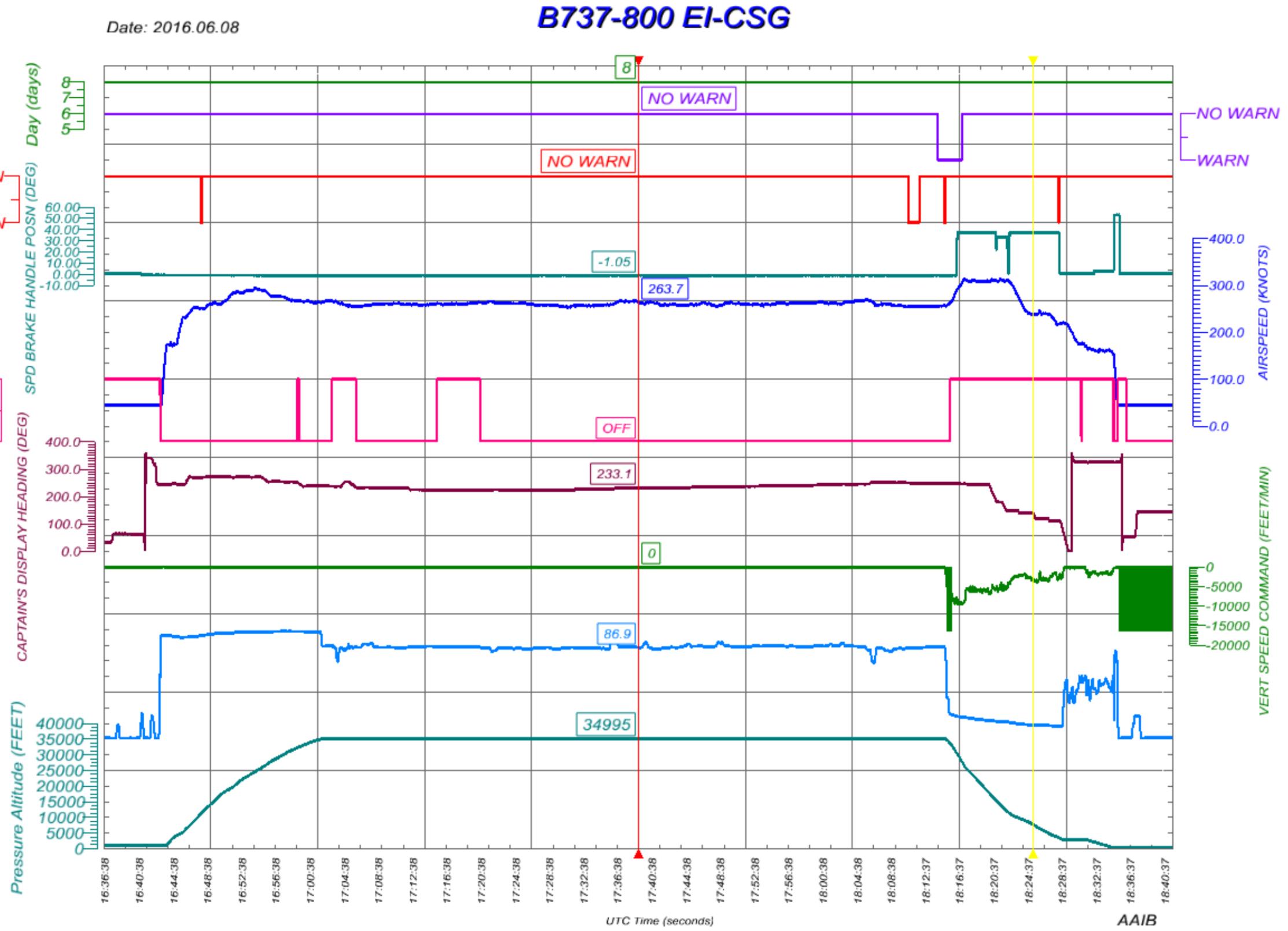


Figure 5. Flight PRG-SVQ (TLS) dated 2016.06.08

### 1.12.3. DCPC NVM data

It is possible to download data from the B737 DCPC's NVM in accordance with the AMM 21-31-00 and use for troubleshooting or preventive actions. NVM is capable to store total of 42 errors.

The failure related informations extracted from the NVM of controller with P/N 0011913, S/N 0319659, provided by the MIAT and shop, have been shown in Table 13 and 14.

fault buffer #	Fault code	auto in ctrl	auto channel fail	flight mode	opmode	auto under test in	manl mode active	auto in ctrl in	bit fault matrix fail contents	Outflow valve position	airplane altitude	cabin altitude	elapsed time counter	flight leg counter
36	254 not used	1	0	ground	auto	0	0	0		110.055				
35	254 not used	1	0	ground	altn	0	0	0		110.098	1110	1102	13848:01:51:15	522134715
34	14 auto under test	1	0	cruise	altn	1	0	0	0: Auto channel fail	13.2578	34017	6803	13845:56:19:4	522134715
33	254 not used	1	0	ground	auto	0	0	0		110.125	341	338	13841:49:58:24	522134714
32	17 not used	0	1	cruise	manual	1	1	0	0: Auto channel fail	39.0352	35001	10010	13840:04:10:4	522134714
31	14 auto under test	1	0	cruise	altn	1	0	0	0: Auto channel fail	9.73828	35001	7189	13840:00:41:65	522134714
30	254 not used	1	0	ground	auto	0	0	0		110.004	477	477	13827:58:4:1	522134710
29	17 not used	0	1	cruise	manual	1	1	0	0: Auto channel fail	47	34612	10028	13826:38:38:65	522134710
28	14 auto under test	1	0	cruise	altn	1	0	0	0: Auto channel fail	13.3789	35007	7189	13825:55:30:94	522134710
27	30 inflow leakage rate	1	0	cruise	auto	0	0	0	0: Auto channel fail	2.90234	40002	7662	13812:53:21:75	522134707

Table 15. NVM data of controller P/N 7121-19971-01AC, S/N 0319659

NVM of controller with P/N 7121-19971-01AC, S/N 0319659 contained total 42 errors, 32 of which have code "30 inflow leakage rate" not caused by the cabin pressurisation system. But "bit fault matrix fail contents" of 37 faults contained "0: Auto channel file" fault. The "17 not used" code shows that cabin altitude exceeded 10000 feet. The "254 not used" code shows that controller was in bite mode (IBIT); "14 auto under test" fail flag will be set if the CTR receives consecutively for 5 minutes an indication that the other CTR performs IBIT while in flight. May be caused by a defect AUTO\_UNDER\_TEST wire outside of the CTR which is fed to 28V\_RTN.

fault buffer #	Fault code	auto in ctrl	auto channel fail	flight mode	opmode	auto under test in	manl mode active	auto in ctrl in	bit fault matrix fail contents	Outflow valve position	airplane altitude	cabin altitude	elapsed time counter	flight leg counter
0	254 not used	1	0	ground	auto	0	0	0		110.137	347	343	59652 hrs 19 mins 21 secs 45 msec	2108777
41	254 not used	1	0	ground	auto	0	0	0		110.125	343	343	59652 hrs 17 mins 8 secs 19 msec	2108777
40	32 CPC97	0	1	climb	auto	0	0	1		0	354	99999	59652 hrs 17 mins 11 secs 44 msec	2108777
39	42 watchdog expired	1	0	climb	auto	0	0	0	0: auto channel fail	14.0625	10976	1601	59652 hrs 17 mins 14 secs 69 msec	2108777
38	30 inflow leakage fail	1	0	cruise	auto	0	0	0	0: auto channel fail	2.70312	34995	7207	59652 hrs 17 mins 17 secs 94 msec	2108775
37	254 not used	1	0	ground	auto	0	0	0		110.066	475	473	59652 hrs 19 mins 21 secs 45 msec	2108773
36	30 inflow leakage fail	1	0	descent	auto	0	0	0	0: auto channel fail	0.578125	28010	6240		2108771
35	30 inflow leakage fail	1	0	descent	auto	0	0	0	0: auto channel fail	2.41016	31646	7030		2108769

Table 16. NVM of controller P/N 7121-19971-01AC, S/N 0011913

NVM of controller with P/N 7121-19971-01AC S/N 0011913 contained total 42 faults, 36 of which have code "30 inflow leakage rate" not caused by the cabin pressurisation system. But "bit fault matrix fail contents" of 37 faults contained "0: Auto channel file" fault. The "32 CPC97" code indicates "Contrlr LRU fail" (The CPC97 gate array tests detected a failure in the CPC97 gate array.), "42 watchdog expired" code shows "Contrlr LRU fail" (This fail flag will be set if the CTR watchdog is not served correctly by the software. May be caused by a software anomaly).

## 2. ANALYSIS

### 2.1. Technical Operation

#### 2.1.1. Pre-incident maintenance

The flight crew reported in TLB 0924889 that during PRG-KGS on 08 Jun 2016, at FL350, the cabin pressurisation system MAN mode selected due to malfunction. The data from FDR and controller NVM show that the cabin altitude exceeded over 10,000 feet. It was not reported in the TLB and not informed to the certifying staff. Onboard engineer performing check in accordance with the FIM 21-31 Task 801 after PRG-KGS flight, recorded "Shows FC014 controller #2. After bite test system check is ok". FIM 21-31 Task 801 says "This BITE procedure must be done on both pressure controllers". It is not clear from the TLB that neither # 1 controller checked and what the result was.

Any other additional maintenance actions were not done after arrival at the MCAA approved outstation located in PRG Airport. The preflight check was performed and certified on TLB at Prague before flight PRG-SVQ on 08 Jun 2016. Preflight check does not include check of cabin pressurisation system.

#### 2.1.2. Controller fault

According to the data of FDR and NVM, following occurred during the flight PRG-SVQ on 08 Aug 2016:

- During the climbing from PRG airport, when # 1 controller with S/N 0011913 serial number was active, fault "32 CPC97" has been recorded,
- At UTC 16:47:46, when flight altitude was about 10,976-11,174 feet, fault "42 watchdog expired" occurred, the Master caution alerted and system transferred to ALTN mode and # 2 controller with S/N 0319659 became active.
- At UTC 18:10:30, when flight altitude was approximately 35,000 feet and cabin pressurisation system was in ALTN mode, fault "14 auto under test" taken place and Master caution alerted,
- In about 3 min 30 sec later above mentioned fault (about 18:13:57 UTC), when flight altitude was around 35,000 feet and the cabin pressure system at MAN mode, cabin pressure decreased, fault code "17 not used" which indicates that the cabin altitude is over 10,000 feet was recorded in controller and cabin altitude warning activated.

According to the shop teardown report, two controllers have been malfunctioned due to following internal defects:

- IC705 part of #1 controller with S/N 0011913 was diagnosed defective and replaced.

- # 2 controllers with S/N 0319659 has not passed the dielectric test, thereby changed the FL1-4 parts of the 28VDC power supply circuit. CMM 21-33-20 says that the fault with code "14 auto under test" might be caused by the damage of the 28V\_RTN power circuit fault. Power supply circuit 28V\_RTN goes through through FL3 filter.

"bit error matrix file contents" of 37 faults of total 42 faults stored in the # 1 controller with S/N 0011913, contained fault "0: Auto channel fail". And "bit error matrix file contents" of 37 faults from total 42 faults stored in the # 2 controller with S/N 0319659 contained fault "0: Auto channel fail". Therefore it is likely that the cabin pressurisation system faults lasted as an intermittent fault for a long period of time.

### 2.1.3. MAN mode operation

Nord-Micro, manufacturer of the cabin pressure controller and outflow valve, provided the following information:

- "The auto motors are locked by their electromechanical brakes, if the corresponding channel is in AutoFail or Standby".
- "Bref position variable is dependent of the chosen control (Manual or Auto) system.
  - o If the manual mode is selected = BREF value is the input from Digital-Selector-Panel (manual open-close switch).
  - o If auto mode is selected = BREF value is the calculated position from Cabin Pressure Control system.

Fault code	Mode	Cabin pressure	OFV position	Bref position	Cabin pressure rate	Ambient pressure rate
"14 auto under test"	ALTN	11.2588 psi Буюу 7189 ft	9.7 degree	9.96	0 slfpm	-7.5 slfpm
"17 Not used"	MAN	10.1025 psi Буюу 10010 ft өндөртэй	39 degree	39 degree	7836.5 slfpm	0 slfpm

Table 17. Data from NVM controller S/N 0319659

To conclude based on the above information and the flight crew statement:

- With the occurrence of "14 auto under test" fault or when Autofail light illuminated, the two controller motors are locked and thereafter outflow valve position 9.7 degrees can only be changed by manual control,
  - After "Auto Fail" light illumination, flight crew selected MAN mode.
  - When the "17 Not used" or cabin altitude exceeded 10,000 feet, the system was in MAN mode, the outflow valve position was 39 degrees, the flight altitude has not been changed and the cabin altitude has increased with rate 7836.5 slfpm.

This shows that the outflow valve position has been changed from 9.7 degrees to 39 degrees in MAN mode and it might be the cause of sudden drop of cabin pressure.

The shop report states that on checking of the outflow valve with P/N 4063-19972-01A, S/N 9912551 and the cabin pressure control panel with P/N 7123-19973-03AB, S/N 99107114 not found any findings. The workscope of the task done on 08 Jun 2016 to replace the outflow valve according AMM 21-31-03 should include Pressurization System Manual Mode Test - TASK 21-31-00-710-801. But both TLB and MLB did not show any records of test results. But it seems that MAN mode of the cabin pressurisation system functioned normally based on the statements done by captain and engineer as well as shop report.

## 2.2. Flight operation

Flight crew actions taken after cabin pressure decrease were analysed based on FDR data, captain statement and informations provided by BEA because CVR data was not available.

Captain stated that: "when pressurization system "MAN" mode was selected, the cabin altitude continuously increased and altitude warning sounded. We following the "Cabin altitude warning or rapid depressurization" checklist donned oxygen masks, set regulator to 100% and established crew communications. And after checking that Pressurization mode selector is in "MAN" mode, we close the outflow valve ...".

QRH "AUTO FAIL or Unscheduled Pressurization Change" checklist said that upon "Autofail" light illuminated again in ALTN mode, directly select the MAN mode to control outflow valve position and cabin altitude. From the statement of the captain, the closure of the outflow flow valve may be done late.

The checklist also warned "Use momentary actuation of the outflow valve switch to avoid large and rapid pressurization changes in the short-term." It can be seen that the cabin altitude could to be increased sharply within short time if outflow valve is moved to opposite direction.

According to the ATC communication recordings taken place between flight crew and air traffic controllers, provided by the BEA, flight crew had lost time attempting to reach understanding with air traffic controllers because crew have not used the standard phraseology (did not report: mayday or pan- pan, did not inform the aircraft failures).

## 2.3. Organisational & Management factors

### 2.3.1. Operator

A maintenance team consisting of five engineers from MIAT has being worked in Prague, Czech Republic. MIAT has entered into agreement with Travel Service, taking

obligation in case of necessity, to provide manpower, tools, equipment and facilities during the wet lease period. The MCAA approved to perform maintenance in Prague outstation on 12 April 2016 (MME 1.8.2.2 Outstation).

Prior to 13 Apr 2016, the aircraft maintenance was performed by MIAT under the scope of certificate no.145.0293 issued by EASA. But during the wet lease period, the maintenance works have being performed under the scope of certificate no. AMO.01 issued by the MCAA according to MCAR-145.

The priviliges of approved maintenance organisation are limited by the scope of category and limitations specified in the certificate. The MCAA may grant a certificate with category A1, A2, C1-C5, E1, F1 and P1. Category F1 is for the maintenance of foreign aircraft and components for foreign aircraft as detailed in the organisation’s exposition and in accordance with a technical arrangement with the State of registry of the aircraft as specified in 145.11 (a) 9/. MIAT certificate was issued with category A1, A2, E1, P1 and without F1. It means MIAT did not have right to perform a maintenance on aircraft registered in Ireland under MCAR-145.

The Attachment “Г” of the MCAR-119 requires developing of procedure on receiving of airworthiness related information from the state of design, assessing and taken appropriate actions in accordance with them. As specified in MIAT MME, Engineering department receives and assesses the relevant airworthiness information provided by the state of design and submits its proposal for required modifications to the Modification review board meeting for approval. The meeting should be done every six months or twice a year according to MME. But this meeting has not being held on time and list of agenda items to discuss does not cover component modification.

2012	Done on 2012.01.26 and 2012.12.26
2013	Done on 2013.09.27
2014	Done on 2014.06.05
2015	Not done
2016	Done on 2016.01.20

Table 18. Modification review board meeting dates

### 2.3.2. MCAA

MCAA has signed a Memorandum of Understanding with the CAA of Czech Republic on the safety oversight of the EI-CSG aircraft for a wet lease period which stated:

- Since the lease agreement is classified as a wet lease-in, the MCAA shall maintain the safety oversight of the aircraft - EI-CSG

### 3. CONCLUSIONS

#### 3.1. Findings

MIAT performed maintenance to foreign registered aircraft according to MCAR-145 when its approved maintenance organization certificate did not have appropriate F1 category.

08 Jun 2016, when both auto channel of cabin pressurisation system became inoperative (Auto Fail failure) during PRG-KGS flight, flight crew has manually controlled the outflow valve. But the crew did not report that cabin altitude has increased over 10,000 feet and cabin altitude warning was activated.

After PRG-KGS flight, onboard engineer recorded in the log book "Shows FC014 controller # 2. After bite test system check is ok ". There is no remark in TLB whether test was done on # 1 controller and if so the result was not listed.

The engineer holds valid aircraft maintenance engineer license. However scope of internal authorization granted by the approved maintenance organization according MCAR-145, does not include the task to check cabin pressurisation system.

Upon arrival on the base station at PRG airport, any additional troubleshooting maintenance was not done.

The flight crew assigned for PRG-SVQ flight had a valid pilot license and a medical certificate.

EI-CSG aircraft departed for PRG-SVQ flight on 08 Jun 2016 at UTC 16:43:42.

At the climbing stage of the flight on about 11,200 feet (around 32 km from the PRG Airport), the Master Caution lights and "Auto Fail" of the cabin pressurisation system illuminated.

During the cruise flight at 35,000 feet over the territory of France (Lat 44632188N, Long 1.793517E, 83 km away from TLS airport) "Auto fail" and Master caution lights illuminated again. At this time the cabin pressure system was in ALTN mode and the outflow valve position was at 9.7 degree.

In about 3 min 30 sec later, when the cabin pressurisation system was transferred to "MAN" mode and outflow valve position was at 39 degree, cabin altitude exceeded 10,000 feet and cabin altitude warning was activated.

The flight crew diverted and landed at Toulouse airport, France.

#### 3.2. Probable causes

The EI-CSG aircraft performed emergency landing in Toulouse France on 08 Jun 2016 due to cabin depressurisation during flight from Prague, Czech to Seville, Spain.

The main reason for the cabin depressurisation is as follows:

The aircraft was dispatched to the flight without rectifying dual auto channel failure occurred during PRG-KGS flight on 08 Jun 2016. And when the failure was repeated again in the flight, crew selected the MAN mode but could not regulate the cabin pressure manually.

### 3.3. Contributing factors

The following factors may have contributed to the cabin depressurization incident and to perform emergency landing:

- The failure of two controllers of cabin pressurisation system,
- Poor reliability of the controllers of cabin pressurisation system,
- Flight crew did not report the cabin depressurisation where cabin altitude reached 10,028 feet and cabin altitude warning activated during PRG-KGS flight on 08 Jun 2016.
- Troubleshooting maintenance was not done completely after the cabin depressurization occurred during PRG-KGS flight on 08 Jun 2016.
- Rupture of flexible hose connecting HPWS mix muff and HPWS condenser as well as 7 structure drain valves have not being closed.

## 4. SAFETY RECOMMENDATION

### 4.1. New safety recommendations

*Safety recommendation 2017-02-09. To MIAT. Replace controllers of the cabin pressurisation system by controllers with higher reliability in accordance with manufacturer recommendation and manuals.*

*Safety recommendation 201702/10. To MIAT. Perform task for download and check of the controllers' memory of cabin pressurisation system with regular interval.*

### 4.2. Previously issued safety recommendations/

The AAIB has issued previously following recommendations related to the findings discovered this investigations.

*Safety recommendation 201603/15. To MCAA. Take complete knowledge exam and flight tests according to MCAR-61 in relation with requirements of appropriate licence types and ratings.*

*Safety recommendation 201603/09. To MCAA. Improve the system for control of compliance with requirements concerning the flight crew training and proficiency test, set forth in the chapters "I" and "K" of the MCAR- 121.*

*Safety recommendation 201603/10. To MCAA. Take actions requiring airlines to perform recurrent simulator trainings, covering all abnormal and emergency procedures and manoeuvres caused by fire, failures and malfunctions of engine, systems and airframe as well as other abnormal situations, completely in accordance with schedule.*

*Safety Recommendation 201611/24. To MCAA. Take the actions requiring air operator certificate holders to comply with the requirements of MCAR 121.385 (b) to preserve the recorder data in the event of an aircraft accident or incident.*

Олон улсын иргэний нисэхийн Конвенцийн Хавсралт 13, Монгол Улсын Иргэний нисэхийн тухай хуулийн [9-р бүлэг] болон Иргэний Нисэхийн Дүрэм 203-т заасны дагуу, шинжлэн шалгах ажиллагааны гол зорилго нь осол, ноцтой зөрчил давтагдан гарахаас урьдчилан сэргийлэхэд оршино. Аливаа ослыг шинжлэн шалгасан үйл ажиллагаа болон түүнтэй холбоотой тайлан нь хэн нэгнийг буруутгах, хариуцлага тооцох зорилгогүй.

Аюулгүй ажиллагааны зөвлөмж нь тухайн хэрэг явдалд хэн нэгнийг буруутгах, хариуцлага тооцох дүгнэлт гаргах үндэслэл болохгүй.

In accordance with Annex 13 to the Convention on International Civil Aviation, Civil Aviation Law of Mongolia [Chapter 9] and Mongolian Civil Aviation Rule's, the sole purpose of this investigation is to prevent aviation accidents and serious incidents. It is not the purpose of any such investigation and the associated investigation report to apportion blame or liability.

A safety recommendation shall in no case create a presumption of blame or liability for an occurrence.

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