FINAL REPORT

2014-401-4P
SERIOUS INCIDENT

BUDAPEST - LHBP
27 September 2014

Airbus A320
D-AIPH

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.

GENERAL INFORMATION

This investigation was carried out by Transportation Safety Bureau on the basis of

- Regulation (EU) No 996/2010 of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation and repealing Directive 94/56/EC,
- Act XCVII of 1995 on aviation,
- ICAO Annex 13 identified in the Appendix of Act XLVI. of 2007 on the declaration of the annexes to the Convention on International Civil Aviation signed in Chicago on 7th December 1944,
- Act CLXXXIV of 2005 on the technical investigation of aviation, railway and marine accidents and incidents (hereinafter referred to as Kbvt.),
- NFM Regulation 70/2015 (XII.1) on technical investigation of aviation accidents and incidents, as well as on detailed investigation for operators,
- In absence of other relevant regulation in the Kbvt., in accordance with Act CXL of 2004 on the general rules of administrative authority procedure and service,

The competence of the Transportation Safety Bureau of Hungary is based on Government Decree № 278/2006 (XII. 23.), and, as from 01 September 2016, on Government Decree № 230/2016. (VII.29.) 23) on assignment of a transportation safety organisation and on the dissolution of Transportation Safety Bureau with legal succession.

Pursuant to the aforesaid laws,

- The Transportation Safety Bureau of Hungary shall investigate aviation accidents and serious aviation incidents.
- Transportation Safety Bureau Hungary may investigate aviation incidents and irregularities which – in its judgement – could have led to more accidents with more serious consequences in other circumstances.
- The Transportation Safety Bureau of Hungary is independent of any person or entity which may have interests conflicting with the tasks of the investigating organization.
- In addition to the aforementioned laws, the ICAO Doc 9756 and the ICAO DOC 6920 Manual of Aircraft Accident Investigation are also applicable.
- This Report shall not be binding, nor shall an appeal be lodged against it.
- The original of this Report was written in the Hungarian language.

Incompatibility did not stand against the members of the IC. The persons participating in the technical investigation did not act as experts in other procedures concerning the same case and shall not do so in the future.

The IC shall safe keep the data having come to their knowledge in the course of the technical investigation. Furthermore, the IC shall not be obliged to make the data – regarding which the owner of the data could have refused its disclosure pursuant to the relevant act – available for other authorities.

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DEFINITIONS AND ABBREVIATIONS

31L RWY	Left hand side Runway with NW – SE direction
31R RWY	Right hand side Runway with NW – SE direction
A-SMGCS	Advanced Surface Movement Guidance and Control System
BA Zrt.	Budapest Airport Plc.
BFU	Bundesstelle für Flugunfalluntersuchung German Federal Bureau of Aircraft Accident Investigation
CAA	Civil Aviation Authority
CVR	Cockpit Voice Recorder
DLH	Deutsche Lufthansa AG
EDDM	ICAO Code for Munich Franz Josef Strauß Airport
EGT	Exhaust Gas Temperature
FCOM	Flight Crew Operation Manual
IC	Investigating Committee
ICAO	International Civil Aviation Organization
ILS	Instrument Landing System
Kbvt.	Act CLXXXIV of 2005 on the technical investigation of aviation, railway and marine accidents and incidents
KHVM	Ministry of Transport, Communications and Water Management
KLH	Military Aviation Authority
LHBP	ICAO Code for Budapest Liszt Ferenc International Airport
LT	Local Time
MIT	Ministry for Innovation and Technology
N1	Low-pressure rotor speed of the Turbine
QAR	Quick Access Recorder
TSB	Transportation Safety Bureau Hungary
V1	Decision Speed, below which the take-off could be aborted

INTRODUCTION

Occurrence category		serious incident
Aircraft	**Class**	fixed wing aircraft
	Manufacturer	AIRBUS INDUSTRIES
	Type	A320
	Registration	D-AIPH
	Flight number	DLH1683
	Operator	Deutsche Lufthansa AG
Occurrence	**Date and Time (Local Time)**	27 September 2014 (07:15)
	Location	LHBP - Liszt Ferenc International Airport – Budapest

The Aircraft was slightly damaged during the occurrence.

Reports and Notifications

The occurrence was reported to the dispatcher of TSB at 07:20 (LT) on 27 September 2014 by the safety dispatcher of Budapest Airport Plc.

TSB Dispatcher:

– reported the occurrence to Hungarian CAA at 07:26 on 27.09.2014,

– reported the occurrence to the investigation organization of the State of the Operator on 27 09 2014,

– reported the occurrence to the investigation organization of the State of the Manufacturer on 27 09 2014.

Investigating Committee

The Director-General of TSB assigned the following Investigating Committee (hereinafter referred to as IC) for the investigation of the serious incident on 27 September 2014:

Investigator-in-Charge (IIC)	Mr György HÁY	Investigator
IC Member	Mr Gergely MARÓTI	Investigator
IC Member	Mr László BOGÁR	Field Technician

Mr. Gergely Maroti Government Official's employment by TSB was terminated during the investigation and Mr. Gábor Torvaji, investigator, was assigned instead of him.

Overview of the investigation process

The IC arrived to the scene of the occurrence, inspected the involved aircraft and listened to the Aircraft Crew. Photographs were taken of the Aircraft and about the onboard documentations. Seized the CVR equipment, downloaded and secured the saved QAR data. The IC interrogated the eyewitnesses. Acquired the reports of the involved services related to the incident. Froze and acquired in copy the whole radio and telephone communication and ground movement information recorded by the A-SMGCS. Also acquired in copies the documentation of the previously conducted maintenance works and the "Technical Log" notice which proved the flying condition of the involved aircraft. Contacted the Investigation Bodies of the State of Manufacture and Registry and the Operators' Safety Manager. Followed up the fate of the engines

dismounted and shipped for repair, particularly the findings of the faulty pipeline. The IC also acquired a copy of an emergency checklist of the FCOM document in case of engine fire from an operator using similar type of aircraft.

A short summary of the occurrence

The pilots of the Airbus A320 Lufthansa flight DLH1683 Budapest – Munich (registration D-AIPH) during the take-off from Budapest shortly before V1 observed the trust fall (N1) of around 10% on Engine № 2. The crew continued the take-off procedure while between 500 – 1000 ft the Engine № 2 fire alarm signal had been activated. Reducing the throttle to idle level, the fire alarm signal disappeared. The crew declared emergency (MAYDAY) turned back to LHBP, executed a traffic circle then landed on RWY 31R with no further difficulties.

Figure 1: *Aircraft involved in the occurrence*

The aircraft was checked on the runway by the Emergency Units of the Airport then – with no trace of fire – the aircraft taxied with its own power to the stand where the passengers and the crew disembarked. The inspection led to the conclusion that the involved engine's malfunction was caused by the broken welding of the pipeline connected to the high pressure stage of the compressor bleed to the pneumatic system. The high pressure hot air disrupted the engine nacelle's inner case and activated the fire warning system.

The damaged engine and certain elements of the nacelle and thrust reverser were replaced at the Budapest base of Lufthansa Technik and were shipped to Hamburg base of Lufthansa Technik for further inspection and repair. The material testing at Lufthansa Technik laboratory concluded the pipeline breakage was caused by fatigue crack which was initiated from a mechanical and heat stressed welding suture.

The IC saw no reason to issue safety recommendations.

1. FACTUAL INFORMATION

1.1 History of the flight

On 27 09 2014 at 07:02 the crew of the Lufthansa flight DLH1683 (Airbus A320 D-AIPH) Budapest – Munich at Gate 43 requested and received the start-up clearance from the Ground Controller (as from now: GRC) at LHBP. Following the engine start at 07:07 by the GRC clearance the crew started taxiing to A2 Holding Point to RWY 31L. At 07:10 the GRC handed over the control to the Aerodrome Controller (as from now: ADC)

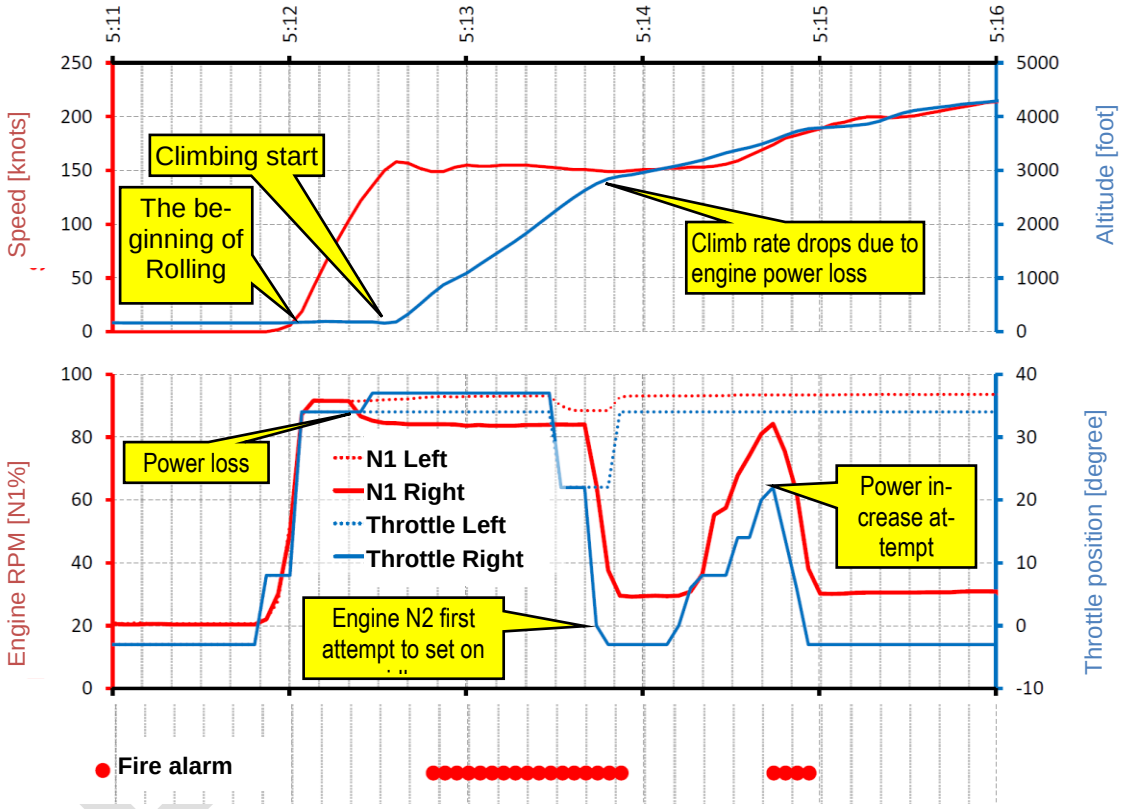


Figure 2: *Major flight and engine data during the take-off and climb phase*

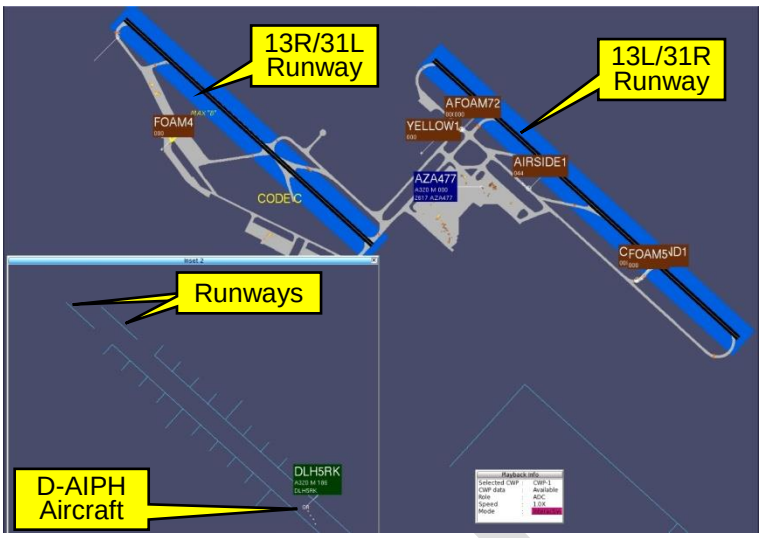


Figure 3: *During the final approach of D-AIPH at 10 NM from the threshold all firefighting equipment was already lined up nearby the RWY*

The ADC cleared the aircraft line up RWY 31L at 07:10 on 27 September 2014. The take-off clearance was given at 07:12 and the aircraft started to roll. Until this point the engines and other systems were operating as usual without any abnormality. During the roll and just before V1 the pilots observed the Engine №2 low-pressure rotor speed dropped by around 10%. The Captain decided to continue the take-off. While climbing, between at 500 – 1000 feet altitude the Engine №2 fire warning system was activated as well. At this time the pilots pulled back the throttle of Engine №2 to idle. Following this procedure the ECAM warning, the Local Warnings and „red fire lights“ disappeared.

After verification of the fire warning by increased the thrust lever the crew realised that this warning was not a false one. The thrust lever was pulled to idle again and the engine fire warning disappeared again. By some interpretation of AIRBUS philosophy, without ECAM warning, there is no mandatory action to shut down the engine anymore. According to the crew report after APU start they observed an EGT fluctuation on engine #1. The crew stated that this observation caused substantial worry about the condition of engine #1 and eliminated the option of shutting off engine #2.

At 07:13 the crew declared emergency (MAYDAY) and communicated the Captain's decision. In first step, to follow the standard departure procedure till 7000 ft. only. The ADC informed the crew that both runways were cleared up for the landing. At 07:15 the crew modified their earlier announcement to climb up to 5000 ft. only and requested clearance to join the left hand traffic circuit for RWY 31L. At 07:17 the ADC cleared the manoeuvre and offered the longer RWY (31R) for landing which was accepted by the crew. At 07:19 the ADC offered radar vectoring control by Approach Unit (APP) on 129.7 MHz frequency which was accepted by the pilots, so they switched over to the given frequency.

Figure 4: *The firefighting equipment catching up the landed aircraft*

APP cleared for the aircraft to descend to 2500 ft. and informed the crew about the readiness of the emergency services at the airport. The pilots requested 10 NM final from APP. The APP initially instructed the aircraft to set heading to 040 degrees then to 330 degrees to intercept localizer for RWY 31R then with a further instruction to follow the ILS for RWY 31R. At 07:20 by the request of the APP the pilots informed them about 159 passengers 7 crew members and 5 tons of fuel is on board. When the aircraft established the ILS for RWY 31R the APP suggested them to switch over to 118.1 MHz again (to ADC frequency).

After the successful radio contact with ADC (at 07:24) the aircraft received the landing clearance for RWY 31R. The ADC reconfirmed them about the emergency units' readiness. The pilot informed the ADC at 07:25 about their plan to stop the aircraft on the RWY so that the emergency units could inspect the aircraft condition from outside and to intervene if necessary. The aircraft landed at 07:27 on RWY 31R and stopped on the RWY between the intersections of high-speed taxiways "Yankee" (Y) and "Zulu" (Z). At this point the alerted firefighting equipment approached and surrounded the aircraft.

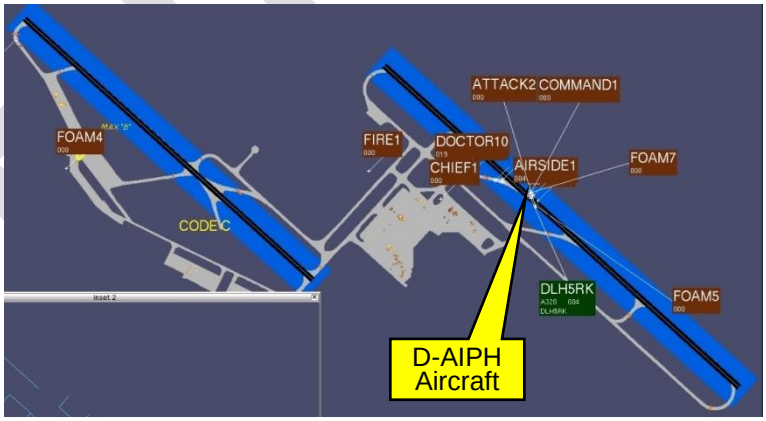


FIGURE 5: *The firefighters are checking the aircraft on RWY 31R*

Five minutes after the landing, at 07:32, the Captain informed the ADC that the leader of the fire brigades was apparently trying to tell them something but they were unable to understand each other. He requested the ADC to mediate between the flight crew and the emergency crews. The ADC passed the message to the Captain that the emergency units wanted to disembark the passengers and the crew on the RWY. The Captain questioned if no damages found visually outside the aircraft they wish to taxi by their own power to the assigned stand where disembarkation could be executed. At 07:37 the ADC authorized the aircraft with passengers to taxi to stand № 227. At 07:44

the aircraft reached the assigned parking position escorted by the emergency units and shot down the engines.

Figure 6: *The firefighters escorting the aircraft to stand №227*

1.2 Injuries

Injuries	Crew		Passengers	Other
	Flight Crew	Cabin Crew		
Fatal	-	-	-	-
Serious	-	-	-	-
Minor	-	-	-	-
None	2	4	159	

1.3 Damage to the aircraft

The right hand side engine (Engine №2) and the nacelle built in together with the thrust reverser was damaged.

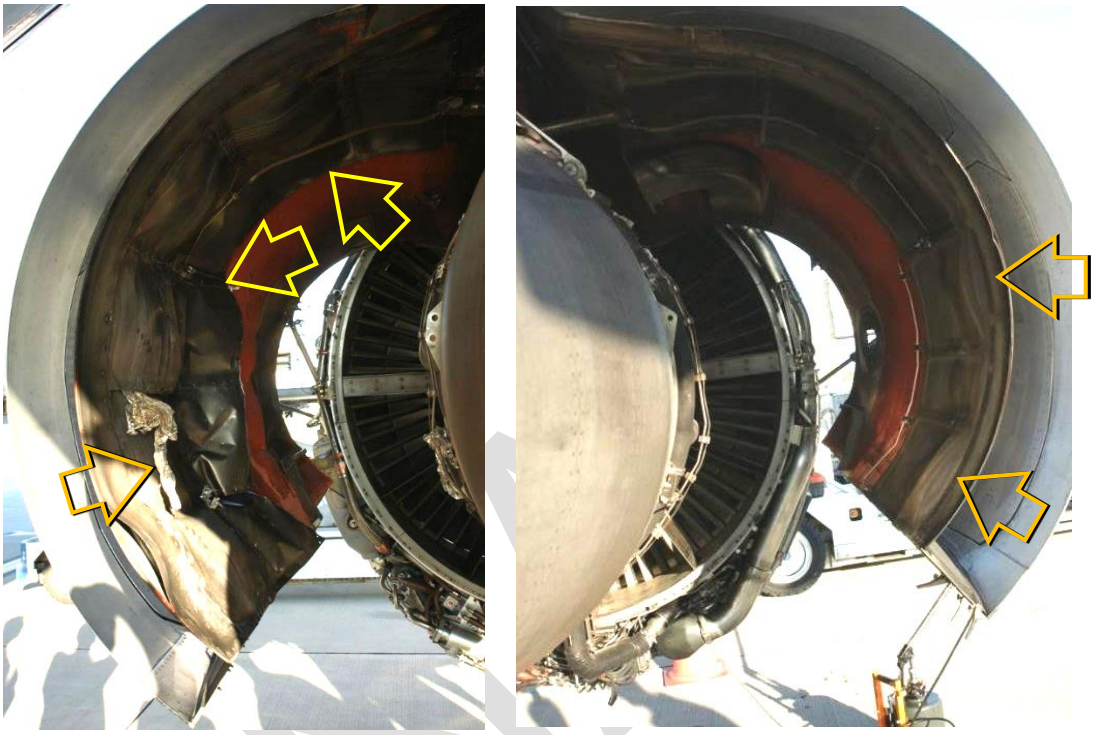


Figure 7: *The left and right side of the damaged engine from backside view with open thrust reverser*

1.4 Other damage

The IC has no information of any other damage occurrence.

1.5 Information on personnel

1.5.1 Captain

Age, Nationality, Gender		39, German, Male
License data	**Type**	ATPL (A)
	Professional validity until	31/12/2015
	Medical validity until	20/11/2015
	Ratings	A320 PIC, A340 COP (IR)
Flying experience in hours	**Total**	8,696 hrs (+406 hrs on simulator)
	in previous 90 days	117.5 hrs (+4 hrs on simulator)
	in previous 7 days	13 hrs 52 min
	in previous 24 hours	4 hrs 24 min
	on the involved aircraft type, total	1,482 hrs (+124 hrs on simulator)

1.5.2 First Officer

Age, Nationality, Gender		32, German, Male
License data	**Type**	ATPL (A)
	Professional validity until	28/02/2015
	Medical validity until	16/06/2015
	Ratings	A320 COP (IR CAT III)
Flying experience in hours	**Total**	4,330 hrs (+476 hrs on simulator)
	in previous 90 days	88 hrs (+12 hrs on simulator)
	in previous 7 days	4 hrs 24 min
	in previous 24 hours	4 hrs 24 min
	on the involved aircraft type, total	4,330 hrs (+476 hrs on simulator)

1.6 Aircraft data

1.6.1. General

Aircraft class	fixed wing
Manufacturer	AIRBUS INDUSTRIES
Type	A320-211
Date of manufacturing	1990
Serial number	MSN0086
Registration	D-AIPH
State of Registry	Germany
Owner	Deutsche Lufthansa AG
Operator	Deutsche Lufthansa AG
Call sign during the affected flight	DLH5RK

1.6.2. Airworthiness

Airworthiness Certificate	**Serial**	086
	Date of issue	31/01/1990
	Valid until	10/07/2015
	Last review	10/07/2014
	Restrictions	none

1.6.3. Engine data

Class	jet engine	
Type	CFM56-5A1	
Manufacturer	CFM International	
Position on aircraft	№1	№2
Serial number	not relevant	731651
Date of manufacture	not relevant	12.1991

1.6.4. Propeller data

Not relevant.

1.6.5 Aircraft loading data

Empty weight		43 137 kg
Take-off fuel weight		5 500 kg
Trade load weight		16 890 kg
Take-off weight		65 527 kg
Flight weight during the occurrence		65 200 kg
Maximum take-off weight		73 500 kg
Maximum landing weight		64 500 kg
Aircraft weight at the time of landing		ca. 64 300 kg
Centre of gravity position at take-off	32.4	index number
Centre of gravity position at the occurrence	32.4	index number
Centre of gravity position allowed (between)	24.26 to 63.9	index number

At the time of landing the aircraft weight did not exceeded the maximum landing weight.

The used fuel type was: Jet A1

1.6.6 Faulty system and equipment information

The aircraft is equipped with two gas turbine engines with high-bypass ratio degrees. The two engines are identical, with same parameters. The engines during their normal operation provide not just the thrust but also the electricity to operate the aircraft systems, producing hydraulic pressure and high pressure air as well.

The failed part supplies the bleed air to the pneumatic system from the engine compressor stage. The high-pressure hot air pipeline directly connected to the compressor house with a screw bond then follows the nacelle curve reaching the high-pressure valve housing manifold section, tightened with a clamp. Regarding the pipeline the nacelle curve shape was developed with bending, where the pipe diameter was needed to be increased, it was solved with welding technology by the manufacturer.

The affected piece of pipeline forwards the bleed air during the low-speed operation of the engine into the high-pressure air valve, which valve steadily approaches its closed position proportionally with the increase of RPM. In its fully closed position the sufficient air pressure is supplied to the pneumatic system from another lower pressure compressor stage bleed-air. In the closed position of the valve the compressor pressure remains the same inside the thin-walled tube section, which causes a substantial stress in the long run.

Name of the faulty equipment / parts	**Bleed air pipeline**
Place of incorporation	Lower part of the engine
Type	Thin-walled steel pipe
Material	Inconel 625
Manufacturer	CFM International
Production date	20/01/1998
Production number	238-0510-501
Serial number	598

The increased stress during the take-off caused the breakage of the pipeline on the affected aircraft.

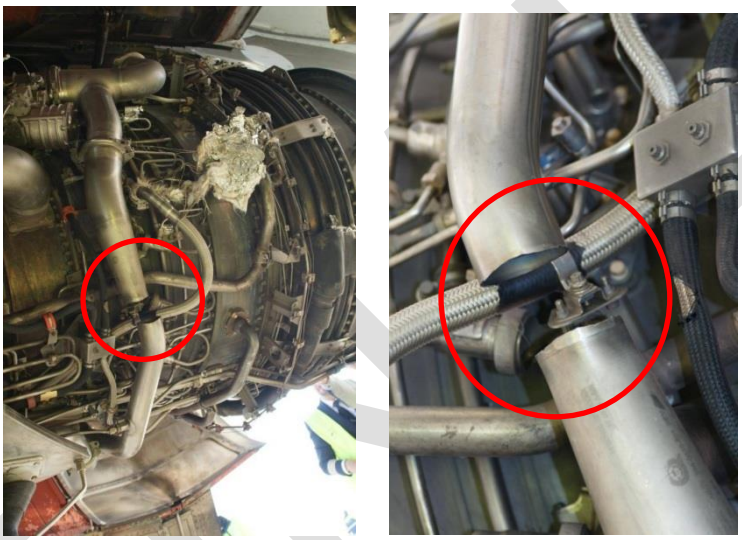


Figure 8: *The broken pipeline in the installation area*

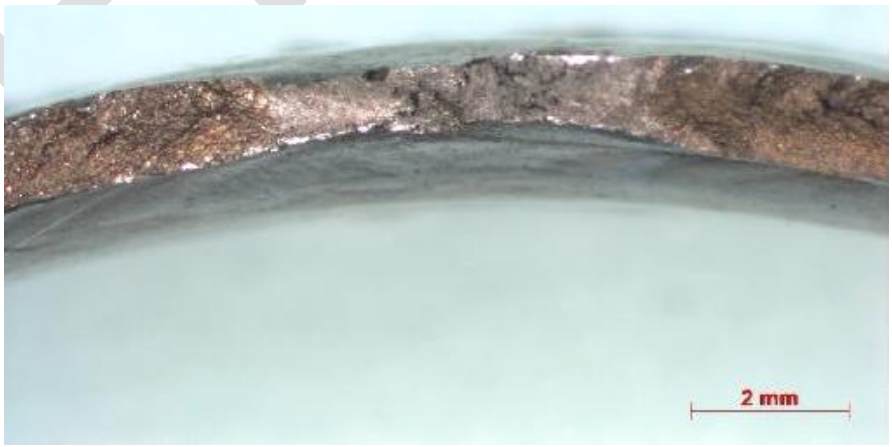


Figure 9: *Evidence of the cracked surface of the pipeline caused by fatigue*

The investigation conducted by Lufthansa Technik could not identify the direct cause of the fatigue initiated pipeline crack but suspected the below facts or combination of those to be the reason:

- physical stress during installation and operation,
- changing the crystalline structure of the material due to the welding process,
- surface roughening treatment prior to the welding result,
- environmental effects: hot air, air pollution, de-icing fluid.

1.6.7 On-board warning systems

All systems worked normally, no indication shown of any malfunction for the IC.

1.7 Meteorological data

The occurrence took place in the morning at daylight in good visibility without any notable meteorological condition. The weather conditions had no effect on the occurrence therefore detailing them is not relevant.

1.8 Navigation aids

According to the Type certificate the aircraft was equipped with the relevant installations, operational dysfunctions were not observed by the IC. The IC did not find noticeable malfunction and did not receive any contrary information about the ground navigational aid equipment. The navigation aids had no effect on the occurrence therefore detailing them is not relevant.

1.9 Communication

According to the Type certificate the aircraft was equipped with the relevant installations, operational dysfunctions were not observed by the IC. The IC did not find noticeable malfunction and did not receive any contrary information about the ground navigational aid equipment they were suitable for the task. The communication equipment had no effect to the occurrence therefore detailing them is not relevant.

1.10 Airport information

The take-off took place at Budapest Liszt Ferenc International Airport (LHBP) at 07:12 LT on 27 09 2014. The planned destination was the Munich Franz Josef Strauß Airport (EDDM).

The actual landing time was at LHBP at 07:27 LT on 27 09 2014.

The affected Airports had a valid operational license. Both Airports' parameters had no effect on the occurrence therefore detailing them is not relevant.

1.11 Flight recorders

The Air Traffic Control service provider and the affected aircraft were equipped with the prescribed and viable data recorder systems and their recorded data were evaluable. The read-out data were in line with the information obtained from other resources.

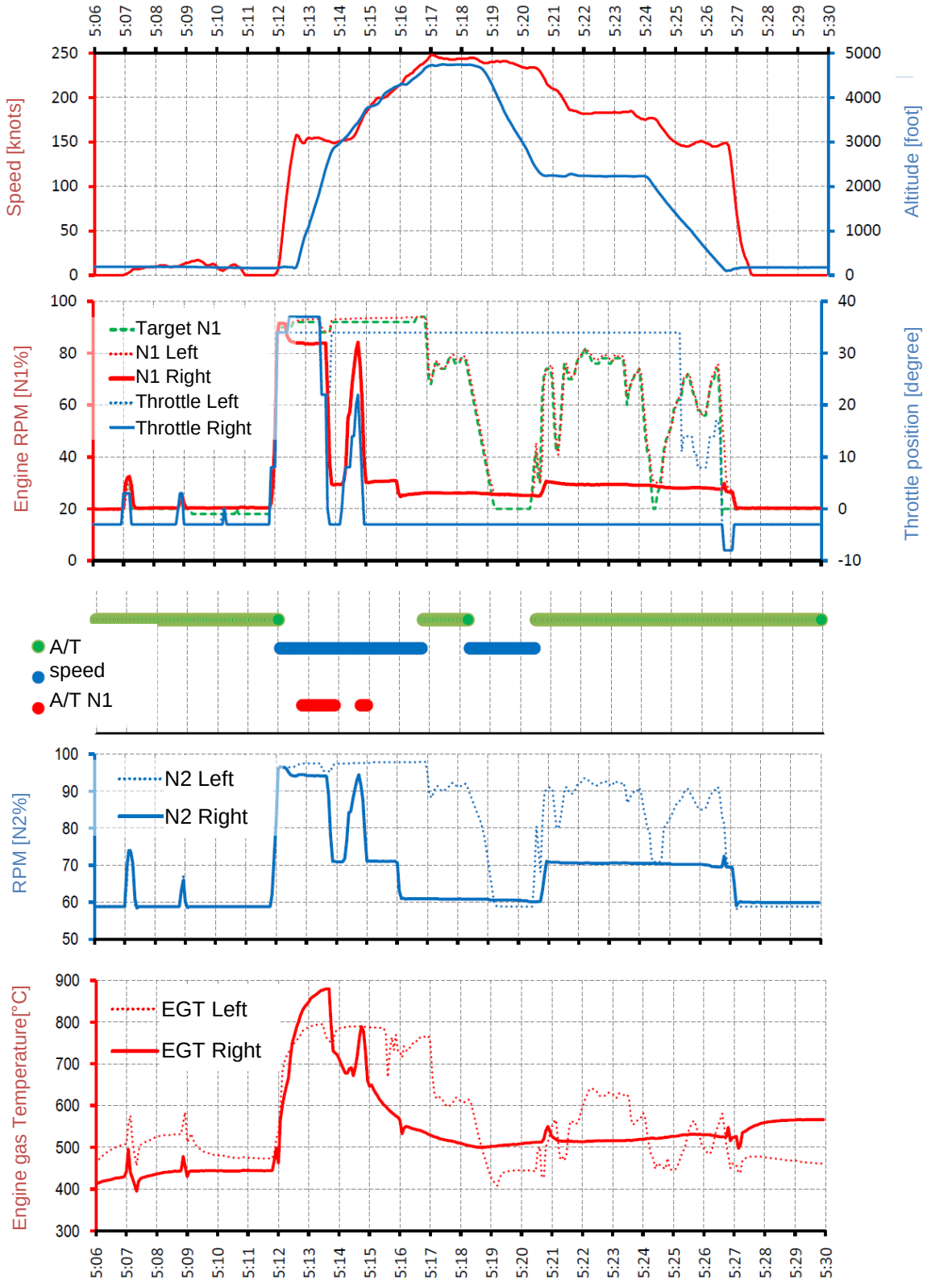


Figure 10: *The evolution of the major flight and engine data during the whole flight*

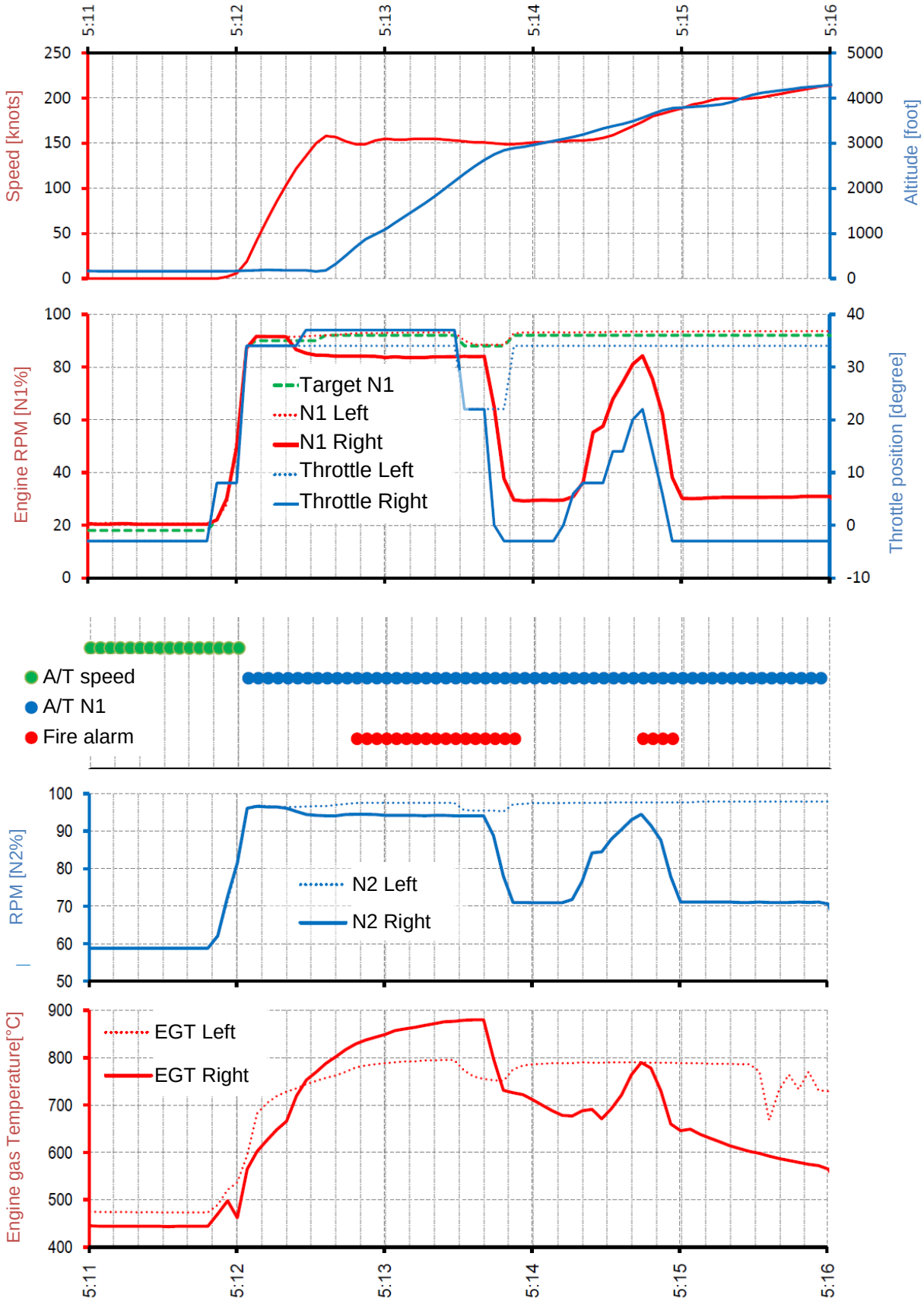


Figure 11: *Major flying parameters and engine data during the minutes of failure*

1.12 Wreckage and impact information

There was no wreckage.

1.13 Medical and pathological information

There was no need for forensic expert examination.

There was no evidence that physiological factors, or other impediments have affected the legal capacity of the personnel concerned.

1.14 Fire

During the incident the fire alarm was activated but actual fire did not occur.

1.15 Survival aspects

No personal injuries occurred.

1.16 Test and investigation methods

The IC received and acknowledged the detailed test report on the substance of the broken air pipe leading to serious damage to the exploration of causes.

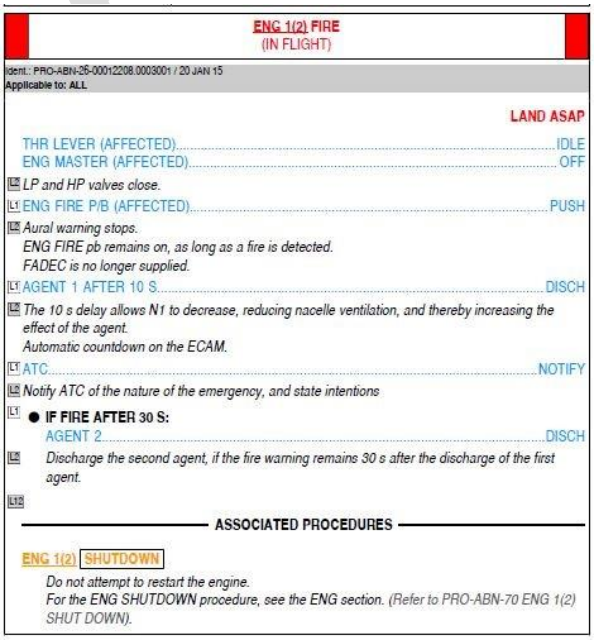
1.17 Organizational and management information

The primary tasks according to the checklist which specifies the pilots the actions to take in the case of in-flight engine fire (fire alarm):

- pull the throttle to idle

- shoot down the engine

If, during the intervention the fire alarm discontinues, the implementation of further actions is not required.



ENG 1(2) FIRE
(IN FLIGHT)

Ident.: PRO-ABN-26-00012208.0003001 / 20 JAN 15
Applicable to: ALL

LAND ASAP

THR LEVER (AFFECTED) ..... IDLE
ENG MASTER (AFFECTED) ..... OFF
L2 LP and HP valves close.
L1 ENG FIRE P/B (AFFECTED) ..... PUSH
L2 Aural warning stops.
ENG FIRE pb remains on, as long as a fire is detected.
FADEC is no longer supplied.
L1 AGENT 1 AFTER 10 S ..... DISCH
L2 The 10 s delay allows N1 to decrease, reducing nacelle ventilation, and thereby increasing the effect of the agent.
Automatic countdown on the ECAM.
L1 ATC ..... NOTIFY
L2 Notify ATC of the nature of the emergency, and state intentions
L1 ● IF FIRE AFTER 30 S:
AGENT 2 ..... DISCH
L2 Discharge the second agent, if the fire warning remains 30 s after the discharge of the first agent.
L2

ASSOCIATED PROCEDURES

ENG 1(2) SHUTDOWN
Do not attempt to restart the engine.
For the ENG SHUTDOWN procedure, see the ENG section. (Refer to PRO-ABN-70 ENG 1(2) SHUT DOWN).

Figure 12: *"Engine Fire" abnormal checklist*

Other features of the organizations involved in the incident did not affect the occurrence, so their detailing is not required.

1.18 Additional information

No meaningful supplementary data was brought to the attention for the IC therefore no additional information is necessary to share with the public beyond the actual data.

1.19 Useful or effective investigation techniques

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

2. ANALYSIS

2.1 The cause of the pipeline breakage and the consequences

Fatigue crack emerged on the thin-walled pipeline which leads the high-pressure air from the engine to the pneumatic system at the welded seam due to combined effect of metalworking, mounting and operation. The continuous widespread over the time eventually weakened the structure so that during the take-off it could no longer bear the load and broke. Since the pipe break occurred between the air flow valve and the compressor stage of the engine, the high-pressure and high-temperature air with excessive force flowed freely into the engine nacelle. The fracture had negative impact on the engine due to the increased air bleed from the compressor, which caused the sudden drop of the RPM. The strong outflow of the hot air overheated and damaged the inner side of the nacelle. The rapid rise of the temperature activated the engine fire alarm system. When the crew reduced the engine thrust power, the hot air flow decreased and the fire warning signal stopped. When thereafter the crew tried to raise the thrust power, the increased flow of the hot air once more activated the fire alarm signal.

2.2 The flight crew's activity

The first signs of abnormal operation of the engine occurred directly during the take-off roll before reaching the V1 speed. The irregularity of the flight at this phase manifested only in a slight decrease of RPM. The captain counted the consequences of the high speed risk factors of the aborted take-off procedure, so he decided to continue the take-off progress. When the fire alarm system of the engine was activated, the crew declared the emergency, stopped climbing and started to return to the airport. Meanwhile, by reducing the thrust on the affected engine they eliminated the fire alarm. Subsequently, attempt were made to increase the engine power, which triggered the reactivation of the fire alarm warning.

After reducing the thrust to idle on the affected engine again, the warnings and the ECAM procedure disappeared. Furthermore, FCOM procedure ENG 1(2) FIRE (IN FLIGHT) was no longer mandatory. Therefore, the crew could follow their own decision making process. The decision to not shut down engine #2 gave them the option of having one more hydraulic pump and generator available. Because of the EGT fluctuation of engine #1 the crew decided to keep engine #2 running in case the other engine failed. This means they accepted the risk of damaging engine #2, but averted the risk of dual engine failure.

In the IC's opinion the crew's decision was in accordance with the AIRBUS documentation but to keep engine running after the fire warning could have had serious consequences in the case of a real engine fire. The captain's request that the passengers should not be disembarked on the runway largely contributed to a fast closing of the emergency.

2.3 Air Traffic Control activity

When the fire alarm appeared the tower provided all clearances and information (radar vectoring via APP) to the aircraft personnel without delay. Simultaneously, with declaration of "expected aircraft emergency" alert ordered the mobilization of the airport services concerned. With such activity the tower facilitated the safe handling of the situation to a reasonable degree. Following the landing and stopping of the service helped as intermediary to overcome the communication difficulties between the fire chief and the crew members.

2.4 The Airport Services activity

The airport emergency service units alerted by the tower lined-up on time nearby the runway. Following the landing and stopping the emergency units entered the runway, surrounded and examined the aircraft. There were no traces of fire, but the emergency crew leader decided to disembark the passengers on the runway. He was not able to communicate his decision to the captain due to technical and linguistic reasons, therefore the tower was asked to be the intermediator. His original decision was eventually changed upon the request of the captain, so the aircraft taxied into the parking position with own power where the passengers disembarked.

3. CONCLUSIONS

3.1 Factual findings

The flight crew had sufficient authorization and qualifications during the incident.

When starting the take-off, the aircraft was capable of flying and had a valid certificate of airworthiness.

According to documents on the regulations in force and the procedures adopted, the aircraft was equipped and maintained properly.

The weight of the aircraft and the centre of gravity were within the prescribed limits.

The aircraft was fuelled with appropriate quality and quantity of fuel.

The flight took place in good weather and in daylight conditions.

With respect to air navigation services, as well as servicing personnel activities and the characteristics of the airport there was no such information that could be brought in contact with the incident occurrence.

A power drop occurred on engine №2 during the last phase of the take-off.

The flight crew continued the take-off procedure.

The engine fire alarm warning activated after the lift-off.

The fire warning and the ECAM procedure disappeared when engine power was reduced to idle. Having no more ECAM procedure available, the crew used its own decision making.

The crew did not shut down engine №2, this gave them the option of having one more hydraulic pump and generator available and therefore maintained a high level of redundancy for the reminder of the flight.

The Crew declared emergency, returned to and landed at the departure airport.

3.2 Factual findings that directly could be linked to the occurrence

During the technical investigation the IC concluded the following causes of the occurrence:

– After the take-off at the initial climb phase the welding of the №2 engine high pressure bleed air pipeline broke up.

– The exhausting high pressure hot air damaged the engine nacelle and activated the fire alarm system.

– The fracture of the pipeline was caused by fatigue crack, which was initiated from a welding seam equally exposed to mechanical and thermal stresses.

4. SAFETY RECOMMENDATIONS

4.1 Measure taken during the investigation

The IC is not aware of any measure taken in connection with the incident during the investigation.

4.2 Recommendations issued during the technical investigation

During the technical investigation, the IC issued no Recommendation.

4.3 Recommendations issued after the technical investigation

The IC did not find any circumstances that would justify issuance of safety recommendations.

Budapest, " 15 " October, 2018

Mr György HÁY
Investigator in charge

Mr Gábor TORVAJI
IC member

Mr László BOGÁR
IC member

NOTE:
This document is the translation of the Hungarian version of the Draft Report. Although efforts have been made to translate it as accurately as possible, discrepancies may occur. In this case, the Hungarian is the authentic, official version.