



FINAL REPORT

**For the investigation of the serious incident of the
aircraft Wizz Air (WZZ) A320, MSN 4716,
With registry markings HA-LWK,
happened on 29.03.2018, in Skopje,
Republic of Macedonia**

Commission for accident investigation

Version:	0.1
Date:	18.01.2019.
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FILE INFORMATION

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File Information	Version:	0.1
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Abstract		
<p>On 29th March 2018, aircraft of operator Wizz Air (WZZ) A320, MSN4716 with Registration HA-LWK equipped with engines IAE 2500, had IFSD on engine No.1, in phase of approach to International airport Skopje (LWSK), Macedonia. Approach to airport and landing was performed without any consequences and with Engine No1 shut down.</p> <p>The investigation was opened upon the legal obligations of the state where the serious incident took place and ICAO Annex 13.</p> <p>The authority of KINSIV is to perform the investigations with its investigators and to prepare a report.</p> <p>No one is allowed to copy, reproduce or spread this report or any part thereof, in any shape and form, and by any means, without the written permit by KINSIV.</p> <p>This report can be freely used solely for the purposes of educational processes.</p> <p>For all additional information, please contact KINSIV.</p>		
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Aircraft accident and incident investigation committee

The committee for investigation of serious incident on aircraft Wizz Air (WZZ) A320, MSN 4716, with Registration markings HA-LWK, which occurred during approach to international airport Skopje, Republic of Macedonia, has been formed with the decision of the Aircraft accident and incident investigation Committee number 06-67/2 dated form 16.05.2018.



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LIST OF ABBREVIATIONS AND TERMS USED IN THE REPORT

AD	Airworthiness Directive
ALT	Altitude
AIP	Aeronautical Information Publication
AFC	Airport flight control
ARO	Air Traffic services reporting office
A/THR	Auto thrust
A/C	Aircraft
ASDA	Accelerate Stop Distance Available
ATIS	Automatic terminal information service
ATS	Air traffic services
CNS	Communication, Navigation, Surveillance
DH	Decision height
DME	Distance Measurement Equipment
ELT	Emergency Locator Transmitter
FAF	Final Approach Fix
FC	Flight Cycle
FDR	Flight Data Recorder
FH	Flight hours
F/O	Flight Officer
FCOM	Flight Crew Operating Manual
HSI	Horizontal Situation Indicator
IFSD	In-Flight Shut Down
CAA	Civil aviation agency
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
IAE	International Aero Engines
HPV	High Pressure Valves
HPC/T	High Pressure Compressor/Turbine
LT	Local time
LWSK	International ICAO marking for airports Skopje



FINAL REPORT

1.0 INTRODUCTION

On 29th March 2018, aircraft of operator Wizz Air (WZZ) A320, MSN4716 with Registration HA-LWK equipped with engines IAE 2500, had engine No 1 stall, resulting IFSD on engine No.1, in phase of approach to International airport Skopje (LWSK), Macedonia. Approach to airport and landing was performed without any consequences and with Engine No1 inoperative.

1.1 NOTIFICATION

The subject serious incident was reported to Airbus by the Committee of incident and accident investigation (KINSIV) from the Republic of Macedonia.

The KINSIV raised an investigation into the event. From beginning KINSIV was in close coordination and helpful cooperation with operator Wizz Air and Ministry of National Development /Transportation Safety Bureau of Hungary (TSB), „Airbus” with BEA as appointed accredited representative, (refer to BEA Accreditation Letter 003939 / BEA / INV) and manufacturer of engine „IAE” – International Aero Engines.

1.2 AIRCRAFT STATUS

Aircraft type : A320-232
Serial Number (MSN) : 04716
Manufacturing date : 26 may 2011
Aircraft Registration : HA-LWK
Engines : IAE V2500 (Model V2527-A5),Serial number V15280
Operator : Wizz Air (WZZ)
Aircraft Total Flight Hours (ATFH) : 25261
Aircraft Total Flight Cycles (ATFC) : 15565

The aircraft Flight Hours and Cycles given here above are the last values known by KINSIV at the time of the incident.

1.3 FACTS RECORDED / FDR

At **20:40:09** UTC A/C was in climb crossing 4700ft RA, MASTER CAUTION triggered for 5 seconds then PACK 2 PB was switched ON and PACK2 Flow Control Valve (PCKFV2) opened.

At **20:59:37** UTC, A/C levelled off at FL350.



At **21:55:55** UTC, A/C started its descent. PRV1 started to oscillate between OPEN and CLOSED position. The ENG 1 regulated pressure (PR1) followed PRV1 position.

At **22:12:05** UTC, while crossing 4300ft STD in descent: - PS31 dropped from 45psi to 26psi in 2 seconds then stabilized around 21psi. - EGT1 started to increase from 390°C to 570°C within 5 seconds, then increased towards 615°C. - PR1 started to decrease from 20.0psi to 8.5psi within 9 seconds. - N1A1 decreased from 26% to 19% in 3 seconds, then stabilized around 17%. - N2A1 decreased from 58% to 38% in 60 seconds.

At **22:12:09** UTC, MASTER CAUTION triggered for 4 seconds. MASTER CAUTION triggered 3 times within the next 19 seconds. EPRC1&2 increased from 0.94 to 1.3. EPRA2 increased accordingly while EPRA1 remained at 0.94. COMMENT: as per PFR, ENG 1 STALL and ENG 1 FAIL were recorded at 22:12 UTC.

At **22:12:38** UTC, Thrust Lever 1 (TL1) was pulled back to IDLE notch. A/THR deactivated. 3 seconds later, AP1 was voluntary disengaged for 4 seconds and MASTER WARNING triggered for 3 seconds. Thrust dissymmetry was countered by rudder and ailerons deflection.

At **22:13:01** UTC, EGT1 was 615°C. ENG 1 Master Lever was set to OFF. MASTER CAUTION triggered for 3 seconds. Main engine 1 parameters (N1A1, N2A1, EGT1 and PS31) decreased accordingly. COMMENT: as per PFR, ENG 1 SHUTDOWN was recorded at 22:13 UTC.

At **22:13:15** UTC, PRV1 closed durably.

At **22:13:23** UTC, AP1/FDs modes changed. The aircraft climbed towards the selected altitude of 6000 ft STD.

At **22:15:26** UTC, TL2 was pushed to CLB notch. A/THR activated.

At **22:15:34** UTC, MASTER CAUTION triggered then TL2 was pushed to MCT notch. COMMENT: the ECAM alert (caution) AUTO FLT A/THR LIMITED most probably triggered at that time.

The rest of the flight was performed uneventfully with the ENG 1 shutdown.

A/C landed uneventfully at 22:32:41 UTC, TL2 was pulled back to IDLE REV while TL1 remained at IDLE notch.

1.4 Description and analysis

Since September 2017, a total of 8 occurrences of engine stall were reported to Airbus and IAE.

In all cases the stall led to an engine In Flight Shut Down (IFSD). Because of the low altitude at which it occurred, the engine was not relighted. The aircraft landed uneventfully.

In depth investigation of these events revealed the following common attributes:

- Events occurred at or below 5,000 feet altitude
- High Pressure Compressors greater than 10,000 cycles since new/overhaul
- Select Two™ configuration, EEC software version SCN22
- Pack OFF or bleed OFF
- normally ON
- BSI clean, removed accessories deemed as non-contributors.



It was identified that under these conditions there was a possibility of engine stall followed by IFSD during descent/approach.

For all reported cases (this one included), it has been analyzed that setting the engine/nacelle anti-ice (NAI) to ON during descent would have prevented the engine stall, as it increases the idle thrust, thus the engine stall margin.

1.5 IAE SHOP INVESTIGATION

IAE performed a teardown of the engine's High-Pressure Compressor (HPC) in June 2018, in presence of Airbus and the Operator. IAE also performed shop investigations of some other engine components and accessories.

HPC Teardown

- Request for extensive HPC gas path measurements defined by IAE Engineering prior to HPC teardown
- Based on measurements that were taken as well as visual inspection of all HPC hardware, no abnormal conditions were noted.

Other Engine Components

- Similar to the HPC, visual inspection indicated no abnormal conditions for other components, including the HPT Engine Accessories,
- Vendor operational tests and inspection were completed for VSV actuator, FMU, 7th and 10th stage bleed valves/solenoids, and fuel nozzles,
- No conditions were identified implicating any accessory as a potential contributor to the descent stall.

1.6 Mitigation / Interim Plan

The investigations were focused on how to increase the stall margin in descent to avoid the stall condition. A solution is to unload the High-Pressure Compressor and increase the Idle and gain stall margin. Use of Nacelle Anti Ice during descent was deemed as beneficial and back to back analysis showed that all cases of stall reported would have been avoided with NAI ON in descent.

Consequently, FOT 999-0094-18-00 was distributed on November 16th, 2018 to all V2500 Operators to provide recommendations to use NAI ON in descent at and below 10,000 ft whenever MMEL was applied to inhibit in closed position Bleed or Pack valves. The MMEL Operational Procedures were modified to add this mention of NAI use in descent.

Finally, FCOM was updated to use NAI in descent in case of failure or closure of Bleed or Pack valves during the flight.



It is to each Operator to determine if they apply the above for the entire fleet or only to the A/C which falls into the conditions of SNC 22 and HPC greater than 10,000 FC since new or overhaul. Reference: GSI 420.1109/18.

1.7 Maintenance Information

In case aircraft bleed or packs are locked closed as per MMEL, it is recommended to perform associated maintenance action as soon as possible if A/C falls under the above listed condition (SCN 22 on Select Two engine and HPC greater than 10,000 FC). Doing this would decrease the time for which Flight Crew would have to apply the NAI ON in descent and thus reduce the actions on their side.

2.0 Final Solution / Terminating action

The permanent solution will be to change the logics of 7A engine stability bleed valve closure, taking into account the bleed consumer's status and ensure enough stall margin in all cases. This will be ensuring via a modification of the EEC software **by creating a new version called SCN 23**. Its associated planning and content is currently being defined between IAE and Airbus.