AIRCRAFT INCIDENT REPORT ZKM KHAIA 002/R

Republika e Kosovës

Republika Kosova-Republic of Kosovo

Qeveria –Vlada-Government

Zyra e Kryeministrit – Ured Premijera –Office of the Prime Minister

Komisioni për Hetimin e Aksidenteve dhe Incidenteve Aeronautike /Vazduhoplovna Komisija za Istraživanje Nesreća i Incidenata/Aeronautical Accidents and Incidents Investigation Commission

Report on Serious Incident of aircraft Airbus A320-232, Orange2Fly, SX-ORG at the International Airport of Pristina, on 1st December 2017

ENGLISH LANGUAGE VERSION

PRISTINA 2018

FOREWORD

This investigation was carried in accordance with the Law No. 03/L- 051 on Civil Aviation of Republic of Kosovo, Regulation AAIIC/OPM no.01/2017 and Annex 13. Aeronautical Accident and Incident Investigation Commission shall be responsible to investigate aviation accidents and incidents within Kosovo territory or which involve airplanes registered in Kosovo, wherever they may be.

The sole objective of the investigation of an accident or incident shall be future prevention of accidents and incidents. It shall not be the purpose of such an investigation to apportion a blame or liability.

It is important to ensure that the investigation is carried independently and in full coordination between the parties involved.

Consequently, any use of this report for purposes other than that of preventing future accidents may lead to erroneous conclusions or interpretations.

This report has been originally written in English language. The Albanian and Serbian translation is also provided for information purposes.

If there are discrepancies between language versions, priority will be given to **ENGLSIH LANGUAGE VERSION**, in accordance with international rules on aviation safety investigation, more precisely to Annex 13 of the Convention of International Civil Aviation

Glossary of Abbreviations used in this Report

AAIIC	Aeronautical Accident and Incident Investigation Commission
ACARS	Aircraft Communication Addressing and Reporting System
AFM	Airplane Flight Manual
AMM	Aircraft Maintenance Manual
AOG	Aircraft on the Ground
AIDS	Aircraft Integrated Data System
AP	Auto Pilot
APP	Approach
ATC	Air Traffic Control
ATPL	Airline Transport Pilot License
A/THR	Auto thrust
BEA	Le Bureau d'Enquêtes et d'Analyses
BKPR	Pristina International Airport "Adem Jashari
BSL	Basel Mulhouse Airport
CAS	Calibrated Air Speed
CVR	Cockpit Voice Recorder
DFDR	Digital Flight Data Recorder
DMU	Data Management Unit
DSP	Datalink Service Provider
EASA	European Aviation Safety Agency
ECAM	Electronic Centralized Aircraft Monitor
FD	Flight Director
FDR	Flight Data Recorder
ft	Feet
ft/min	Feet per minute
FDMS	Flight Data Management System
FDIMU	Flight Data Interface Management Unit
FCOM	Flight Crew Operating Manual
FMGS	Flight Management Guidance System
G	G-Force
GW	Gross Weight
hPa	Hectopas cal
ICAO	International Civil Aviation Organization
kt	Knot(s) 1 kt = 1,852 km/h
LHT	Lufthansa Teknik
MLG	Main Landing Gear
MEL	Minimum Equipment List
MMEL	Master Minimum Equipment List
METAR	Aviation Routine Weather Report
MRO	Maintenance, Repair, Overhaul

NOTAM	Notice to Airmen
NM	Nautical Miles
PAPI	Precision Approach Path Indicator
PF	Pilot Flying
PIC	Pilot in Command
PM	Pilot Monitoring
PRN	Pristina International Airport
QFU	Magnetic Heading of a Runway
RA	Radar Altimeter
RALR	Radio Altimeter Rate
RW	Runway
SLA	Service Level Agreement
SOP	Standard Operating Procedure
SNOTAM	Notice to Airman for Snowing
UTC	Universal Time Coordinated
VLS	Lowest Selectable Airspeed
VRTA	Vertical Acceleration
VOR/DME	VHF omnidirectional range (**VOR**)/ distance measuring equipment (**DME**)

Contents

GENERAL INFORMATION

State File Number:	ZKM KHAIA – 002/R
Classification:	Serious incident
Date, time of occurrence:	1 December 2017, 23:49 hours
Location of occurrence:	Pristina International Airport Adem Jashari (PRN)
Aircraft registration:	SX-ORG,
Aircraft model:	Airbus A320-232
Type of aircraft:	Fixed Wing – twin engine, passenger aircraft
Type of flight:	Passenger flight
Phase of operation:	Landing
Damage to aircraft:	None
Total crew onboard:	6
Passengers:	178
Injuries to Persons:	None
Other damage:	None
Weather/Lighting conditions:	Snow/Night
Information Source:	Aeronautical Accident and Incident Investigation Commission AAIIC

Summary

On date 01.12.2017 at 23:49 local time the aircraft Airbus A320 -232 with registration mark SX-ORG and serial number 1407 operated by ORANGE2FLY was on a commercial flight under call sign OTF3564 from Basel Mulhouse to Pristina. During the landing the aircraft made a Hard Landing categorized as “Severe Hard Landing”. The possibility of a landing parameter exceedance was not reported by the crew following their internal post landing briefing. The crew thought the landing was normal because of the weather conditions and everything was within the limits. The aircraft has flown 8 more sectors to the destination and back. On date 05.12.2017 the aircraft was grounded in Pristina Airport after the paper was install in the DMU and reading of Load Report <15>. The data on the Load Report showed that the aircraft had exceeded the allowed landing parameters and the landing has been categorized as *Severe Hard Landing.*

The AAIIC of Republic of Kosovo was notified about this incident from Hellenic Safety Investigation Authority, Air Accident Investigation and Aviation Safety Authority (AAIASB), on date 11.12.2017 through e-mail and telephone, after the A/C was grounded in the Pristina International Airport. The AAIIC members after collecting all the relevant information and visiting the aircraft, requested to the board of the AAIIC the need of opening an investigation. The initial notification to all related parties for opening of investigation was carried on 20.12.2017.

1. FACTUAL INFORMATION

1.1 History of the Flight

On December the 1st at 20:55 h [1] the aircraft Airbus A320-232 registered SX-ORG operated by Orange2fly took off from Basel Mulhouse Airport (BSL) and landed on Pristina International Airport (PRN) at 23:49 h [1] local time. The SX-ORG was operating a night charter flight and there were 6 crew members and 178 passengers on board of the aircraft. The pilot in command (PIC) was pilot flying (PF) and was seated on the left side while the co-pilot was pilot monitoring (PM) and had occupied the right seat in the cabin. The approach was conducted on runway 35 via VOR/DME P (non-precision approach).

The weather on the day of the incident in the Pristina Airport at 22:30 UTC according to METAR information was: Light Rain Snow, Wind Direction 320 [0] (degree), Wind Speed 7 knots (kt).

The Operators had internal Procedures where states that all the landings at the Pristina Airport will be made by the Captain seated on the left side of the cockpit (the more experienced one of the flight crew).

Figure 1. Seating position in the cockpit. *Source: Airbus*

During the flight the Pilot Flying (CM1) had an issue with the Left Sliding Window. The heating in this window was not working and the Captain had foggy window and almost no peripheral view. This issue was an MEL Item and the flight crew were informed about this issue through Aircraft Technical Logbook. According to Airbus Report and the data downloaded from FDR shows that the flight towards Pristina progressed normally and the Pilot Flying (CM1) prepared the aircraft for a flap FULL landing on Runway 35 adjusting the approach speed in the FMGS to ensure a five knot margin above VLS.

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[1] *All times local, unless otherwise stated.*

The flight crew disengaged the autopilot at 2000ft RA, and the aircraft was manually handled by PF and left the auto thrust (A/THR) engaged and active. The speed was managed by the crew and CAS was following the speed target

At 3 NM the flight crew had visual contact with the runway. At 1000 ft RA the PM called out the stable approach parameters with accordance to operator SOPs the final approach of the aircraft was consider as stabilized.

The pilot and co-pilot conducted a briefing during the landing approach and agreed to have a Positive Landing[2] because of the weather conditions (snowing).

The crew reported they did not feel any abnormality during the landing and everything seemed normal. The flight crew also did a post landing briefing and discussed the landing and both agreed that the landing was not "unusual landing" because of the Positive Landing. There were no fault messages from the ECAM (Electronic Centralized Aircraft Monitor) and the FMGS (Flight Management Guidance System), as per system intent. The automatic print out of the LOAD <15> report did not occur due to missing paper in the DMU (Data Management Unit), and the flight crew were in knowledge about this fact (MEL items 31-30-07 A).

There were no actions taken by the PF regarding the landing, there was a post landing discussion between the flight crew and the cabin crew about the landing and the PF stated that the landing was a little bit hard but within the limits. No recordings were taken into the aircraft technical log book by the PF.

The aircraft continued to fly 8 more sectors to the destination Basel Mulhouse and back to Pristina. Two days after the hard landing the co-pilot had a private talk with the Training Manager of the Operator regarding the night of the incident because he was doubtful about that landing and after the conversation, immediate actions were taken to load paper in the DMU. On date 05.12.2017 the DMU was filled with paper and generated LOAD <15> report and the parameters shown on the report were that VRTA (vertical acceleration) was 3.04 G. The data had exceeded the limit given by the Airbus AMM and the aircraft was declared AOG and grounded for further checks on 6th of December. On 15th of December the Airbus provided the special permission to fly to Craiova, Romania MRO, following detailed inspections. All inspections were completed before permanent release and all four Main Landing Gear wheels and the RH shock absorber assembly were replaced

The aircraft was released to service on 28th of December.

[2] A **positive landing** in the sense of avoiding hydroplaning, is a **landing** where the aircraft vertical speed is sufficient for the tires to 'cut' through a thin layer of water and make a good ground contact to achieve quick wheel spin up.

1.2 Personnel Information

1.2.1 Pilot in Command (PIC)

The pilot in command was a Captain and was a Pilot Flying (PF), he had an ATPL (A) flying license issued in accordance with Part-FCL by Hellenic Civil Aviation Authority. The license had been issued on 05.10.2005. He had license for type rating for A320 and it was valid until 30.10.2018.

The Captain had a Class 1 medical certificate valid until 21.05.2018 and Class 2 valid until 21.11.2018

He had a flying experience on Airbus A320 of 688:00 hours, and his total flying experience was 10078:00 hours.

1.2.2 Co-pilot

The Co-pilot was a First Officer and was a Pilot Monitoring (PM), he had an ATPL (A) flying license issued in accordance with Part-FCL by Hellenic authorities. The license had been issued on 21.02.2000.

The First Officer had a Class 1 medical certificate valid until 27.04.2018 and Class 2 valid until 27.04.2018.

He had a flying experience on Airbus of 406:00 hours, and his total flying experience was 7356:00 hours.

1.3 Aircraft Information

The **Airbus A320 – 232** is a low wing transport aircraft equipped with two-engine, short- to medium-range narrow body with a capacity of maximum 180 passengers.

Manufacturer:	The Airbus S.A.S
Type:	Airbus A320 - 232
Manufacture date:	February 20, 2001
Serial number:	1407
Maximum Take-Off Weight:	77 000 Kg
Engines:	Two V2527-A5
Total passenger:	178

The aircraft had a certificate of registration from the Civil Aviation Authority of Hellenic Republic and was operated by Orange2fly Air Operator. A valid airworthiness review certificate (OTF) had been provided to the AAIIC by the Hellenic Civil Aviation Authority.

Figure 2: Picture of the aircraft *Source: Orange2fly*

1.4 Meteorological Information

According to Pristina International Airport "Adem Jashari" (BKPR) weather observation at 22:30 UTC: visibility 8000 m, light rain snow, scattered clouds at 1400ft, broken clouds at 4000ft, direction of the wind 330°, speed of the wind 7kt, pressure 1011 hPa, temperature +2°C, dew point at 0°C.

For the landing the valid Meteorological Aviation Weather Report (METAR) was:

BKPR, Pristina (Kosovo).
WMO index: 13481. Latitude 42-39N. Longitude 021-09E. Altitude 545 m.

METAR/SPECI from BKPR, Pristina (Kosovo).

SA	01/12/2017 23:30->	METAR BKPR 012330Z 34006KT 4000 -SHSN BR SCT010 OVC025 01/M01 Q1011 NOSIG RMK 17290095=
SA	01/12/2017 23:00->	METAR BKPR 012300Z 32006KT 5000 -SN BR SCT010 OVC025 01/M01 Q1011 NOSIG RMK 17290095=
SA	01/12/2017 22:30->	METAR BKPR 012230Z 33007KT 8000 -RASN SCT014 BKN040 02/M00 Q1011 NOSIG RMK 17290095=
SA	01/12/2017 22:00->	METAR BKPR 012200Z 32006KT 8000 -RASN SCT012 OVC030 02/M00 Q1011 NOSIG RMK 17290095=

Figure 3: METAR information 18 minutes before the event *Source: BKPR*

The next METAR information was published 12 minutes after the event with no significant change.

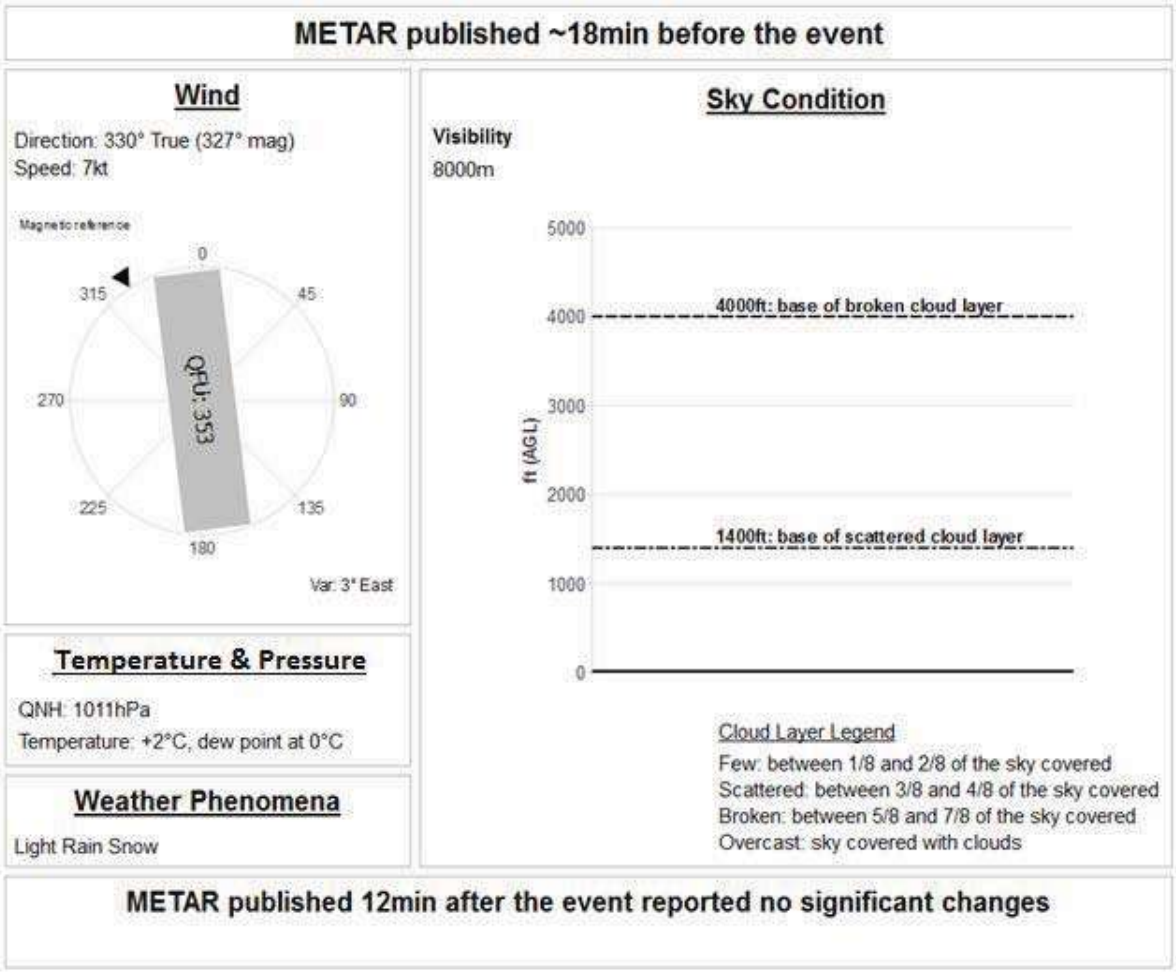


Figure 4: Illustrated METAR information *Source: Airbus*

The data from METAR were consistent with the data downloaded from DFDR.

1.5 Aids to Navigation

At the night of the event, the Runway 35 was used for landing by Orange2fly at Pristina Airport (BKPR). Runway 35 is a Non-Precision Approach, VOR/DME P and some of the runway characteristics are as follow:

- QFU 353°
- Length 2501 m
- Width 45 m
- Elevation 1786ft

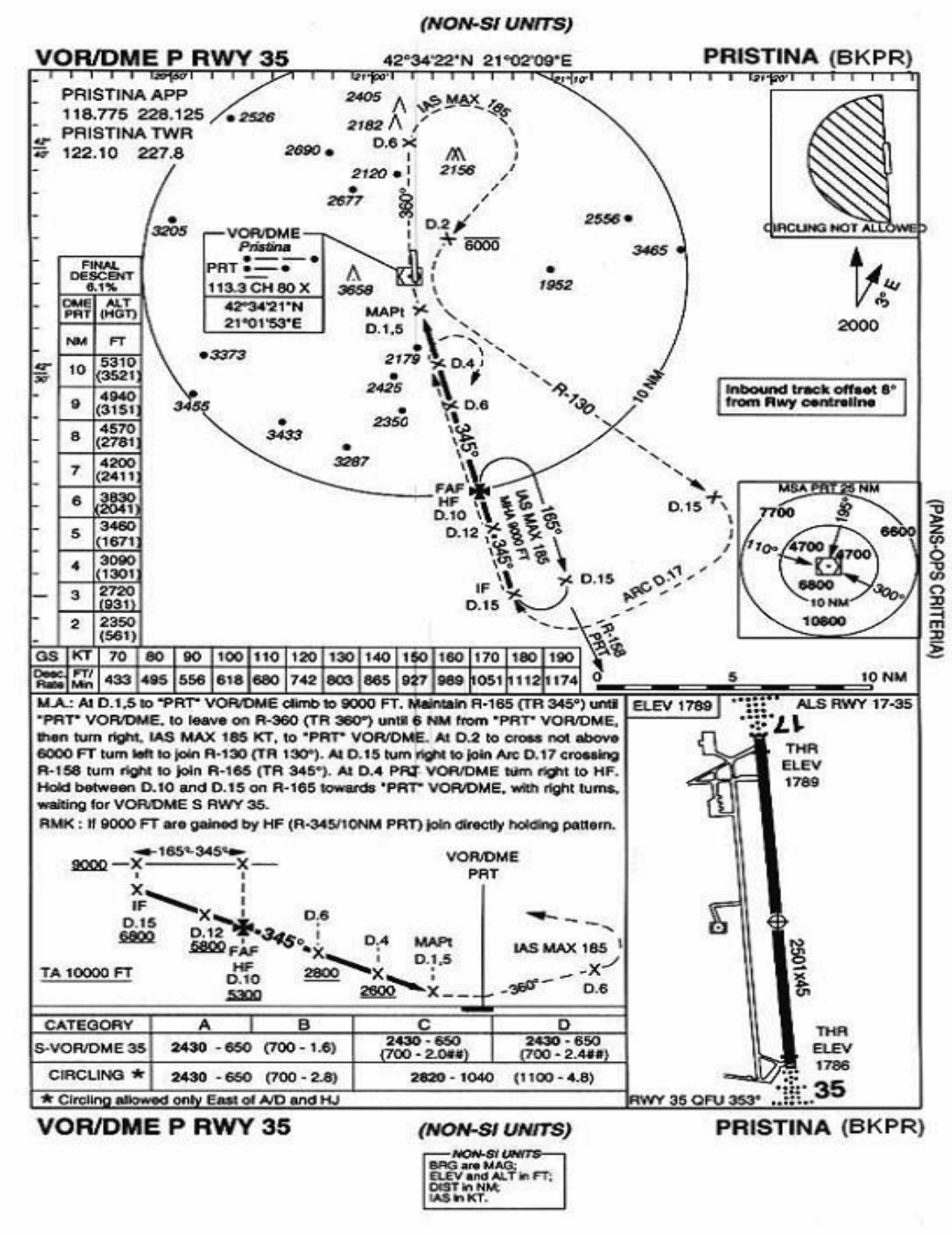


Figure 5: Runway 35 VOR/DME P approach chart *Source: AIP Kosovo*

During the final approach at Runway 35 VOR/DME P there is a need for a right turn. This right turn happens at approximately 500ft RA.

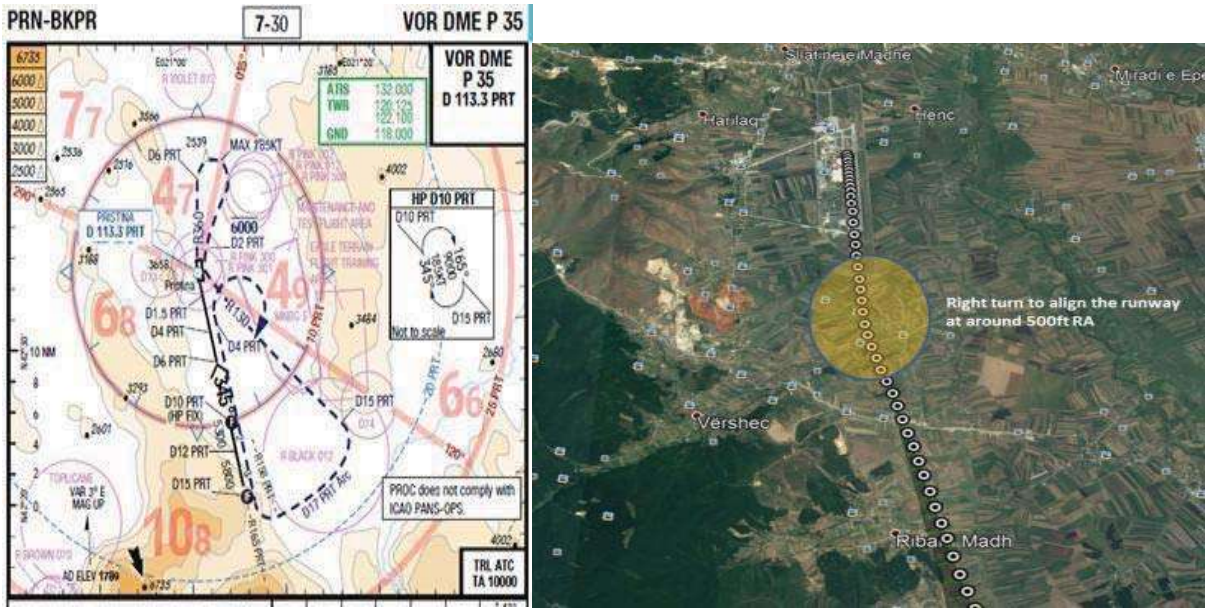


Figure 6: Pristina Approach Runway 35 *Source: Airbus*

1.6 Communications

The aircraft performed 8 further flights from/to, Pristina/Basel Mulhouse after to the incident flight and before the aircraft was declared AOG consequently the Cockpit Voice Recorder CVR was overwritten. The only available communication prior to this incident is the communication between pilots and Air Traffic Control (ATC) in Pristina. The communication was provided to AAIIC by Air Navigation Service Agency of Republic of Kosovo, the communication was conducted in English language.

1.7 Aerodrome Information

Pristina International Airport “Adem Jashari” (BKPR) is located 15 km south-west of Pristina city and 3 km south of Slatina. The airport has 1 runway with the orientation 176°/356°.

Runway designator:	17 / 35
Runway dimension:	2 500 m x 45 m
Runway surface:	Asphalt
Aerodrome reference code:	4C

Pavement surface and bearing strength is asphalt PCN 100/F/B/X/T. RW17 slope 0.04 % down. Runway 17 has precision approach, category II (CATII). Runway 35 has non - precision approach. Physical characteristics of runway are in compliance with the standards of ICAO Annex 14. The NOTAMS showed no limitations for the conducted approach.

Declared Distances:

Runway 17 and 35:

TORA (Take-off Run Available):	2 501 m
TODA (Take-off Distance Available):	2 501 m
ASDA (Accelerated Stop Distance Available):	2 501 m
LDA (Landing Distance Available):	2 501 m

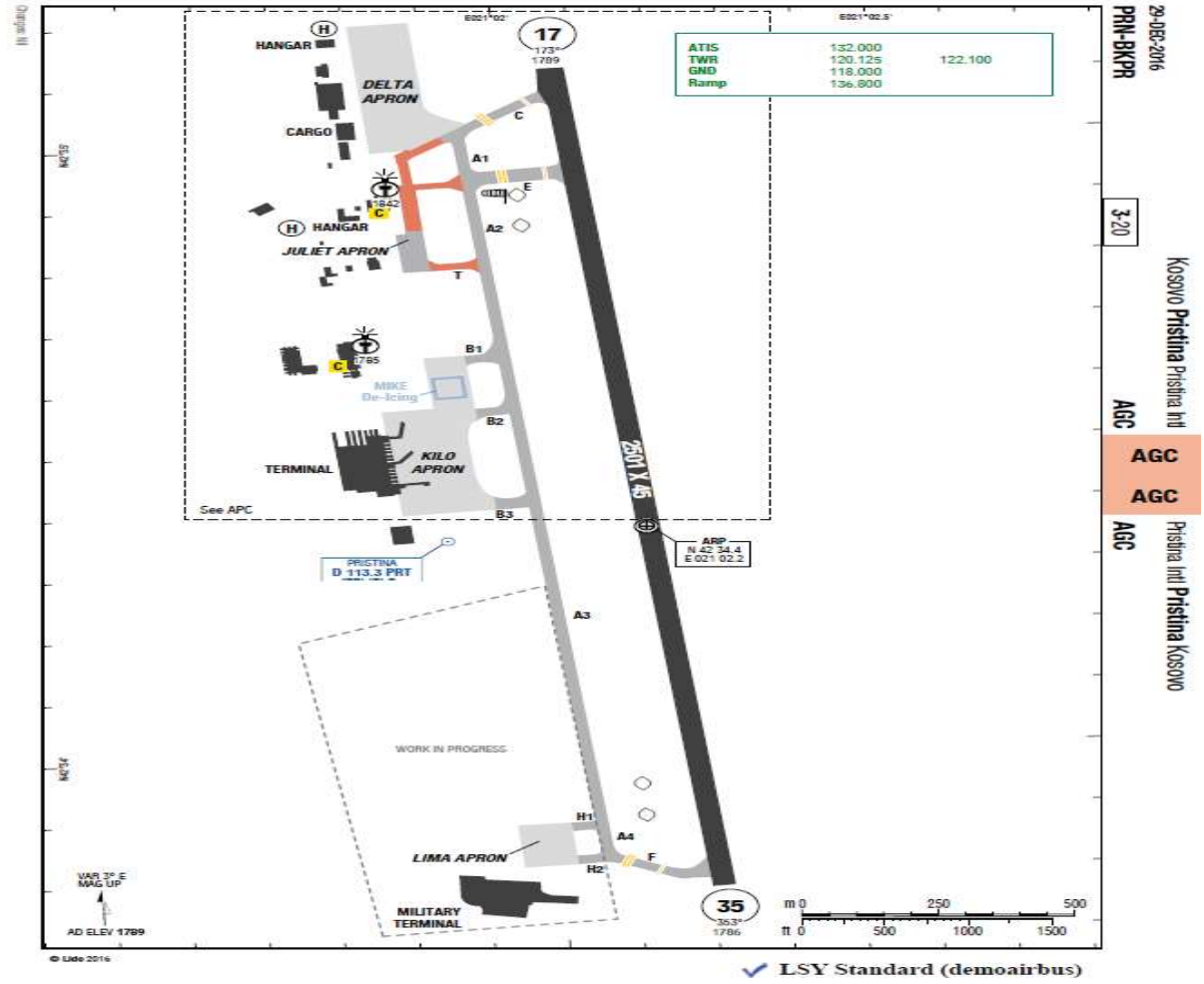


Figure 7: Pristina International Airport Adem Jashari *Source: Airbus*

1.8 Recorders

The Flight Data Recorder (FDR) for this event was a Digital Flight Data Recorder (DFDR) and was provided by the operator. Prior to the four consecutive flights after the incident the CVR was overwritten. Flight data was recovered and extracted from the Flight Data Recorder (FDR)

1.8.1 FDR Parameter Description

The following information was derived from the FDR data provided by the manufacturer (Airbus) for the approach and landing of the SX-ORG in the Pristina Airport.

At 2000ft RA the Autopilot (AP1) was disengaged by the flight crew, the PF was manually flying the aircraft and the aircraft configuration was CONF FULL (Slats/Flaps 27°/40°), the landing gear was selected down, Auto brake was armed in MED mode and ground spoilers were not armed. The Flight Directors (FDs) were engaged in DES (vertical) and NAV (lateral) modes. The Auto thrust (A/THR) was engaged and active in "THRUST" mode, Lowest Selectable Airspeed VLS was 133kt, and speed target was managed at 138kt (VAPP=VLS+5kt) so the CAS was 138kt. Rate of descent was approximately 1400ft/min with Pitch angle 0° and heading 2° higher than final approach heading (final course approach 345°).

At the final approach during the alignment of the aircraft to the runway approximately 300ft the ground spoilers were armed, both FD's (Flight Directors) were disengaged.
On the longitudinal axis the PF side stick inputs varied between ~3/5 of full nose up and 3/4 of full nose down deflection. Pitch angle varied between -2.5° (nose down) and +4.5° (nose up).
Speed target varied between 138kt and 141kt. CAS varied between 133kt (VAPP-5kt) and 142kt (=VAPP+2kt). Rate of descent varied between ~2400ft/min (around 1900ft RA) and ~600ft/min. Vertical load factor varied between +0.9G and +1.1G.
On the lateral axis PF side stick inputs varied between ~1/2 of full right and ~3/5 of full left deflection. Roll angle varied between -3° (left wing down) and +10° (right wing down). Heading increased from 341° (final approach course) to 353° (QFU 353°). Drift angle varied between -3° (aircraft nose toward to the left of the track) and +2° (aircraft nose toward the right of the track). No significant lateral load factor was recorded.
Between 300ft RA to flare 20ft RA on the longitudinal axis, the PF side stick inputs varied between ~1/2 of full nose up and ~3/4 of full nose down deflection. Pitch angle varied between +2° (nose down) to +6° (nose up). Rate of descent varied between 880ft/min and 200ft/min. Vertical load factor varied between +0.8G and +1.1G. Speed target decreased from 141kt and 138kt. CAS varied between 134kt (=VAPP-6kt) to 139kt (=VAPP-2kt).

On the lateral axis the PF side stick varied between ~3/4 of full right and left deflection. Roll angle varied between +4° (right wing down) to -3° (left wing down). Rudder pedal input was applied up to ~1/4 of full left deflection. No significant lateral load factor was recorded.
Drift angle increased from 0° to +3° (aircraft nose toward the left of the track).
Heading decreased from 353° to 350° (QFU 353°).

From flare at 20ft RA to touchdown on the longitudinal axis a full back stick was applied by PF, pitch angle gradually increased from +2° to +3.5°. Vertical load factor varied between +0.96G and +1.05G. Rate of descent decreased from ~880ft/min to ~420ft/min. CAS decreased from 138kt (VAPP) to 135kt (VAPP-3kt). Auto thrust still engaged. On the lateral axis the PF side stick input varied between ~1/2 of full right and ~1/4 of full left. Roll angle increased from +0° to +2.5° (right wing down). Rudder pedal input was maintained to ~1/4 of full left deflection. Heading remained around 350° (QFU353°). Drift angle reached +3° (aircraft nose toward the left of the track).

The aircraft touched down with following data: on the longitudinal axis**:**
- +3.5° of pitch angle.
- -17ft/s (±2ft/s) of recalculated aircraft vertical speed.
- +3.0G of vertical load factor.
- +2.5° of roll angle (right wing down).
- +3° of drift angle (aircraft nose to the left of the track)
- Thrust levers were retarded to “IDLE” and A/THR disengaged.
- Ground spoilers started to extend.
- CAS was 135kt (=VLS+2kt).
- Ground Speed was 138kt.

And on the lateral axis**:**
- 350° of heading (QFU 353°).
- +3° of drift angle (aircraft nose toward the left of the track).
- Lateral load factor was at +0.3G (consistent with drift angle).

The above mentioned are graphically illustrated in the figure below.

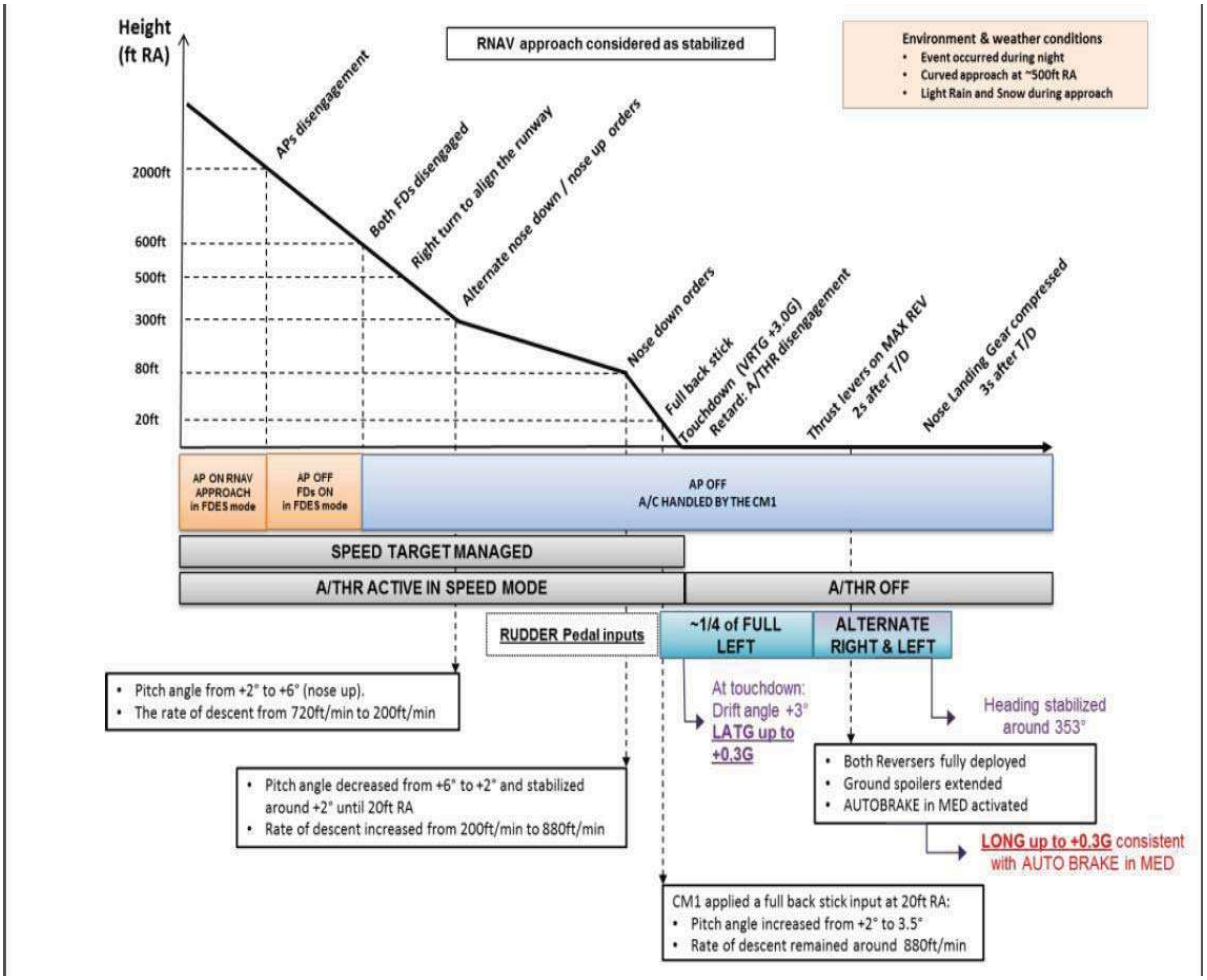


Figure 8: The approach sequence and touch down *Source: Airbus*

On the following figures below there are all relevant parameters in relation to approach and touch down phase.

1.8.2 Approach phase

The figure shows the approach phase on the longitudinal axis.

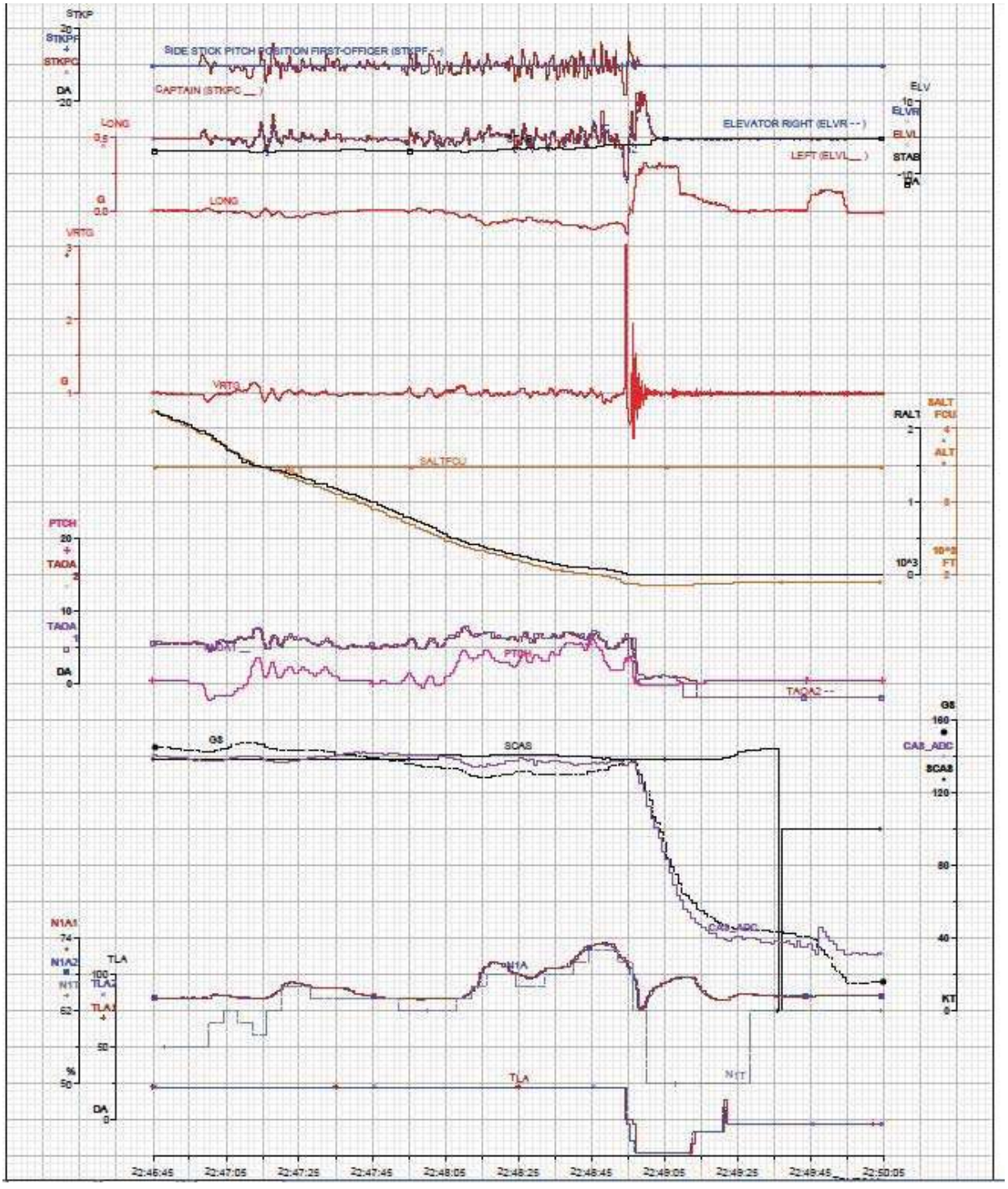


Figure 9: FDR parameters of the approach phase *Source: Airbus*

1.8.3 Landing phase

The figure shows the landing phase on longitudinal axis.

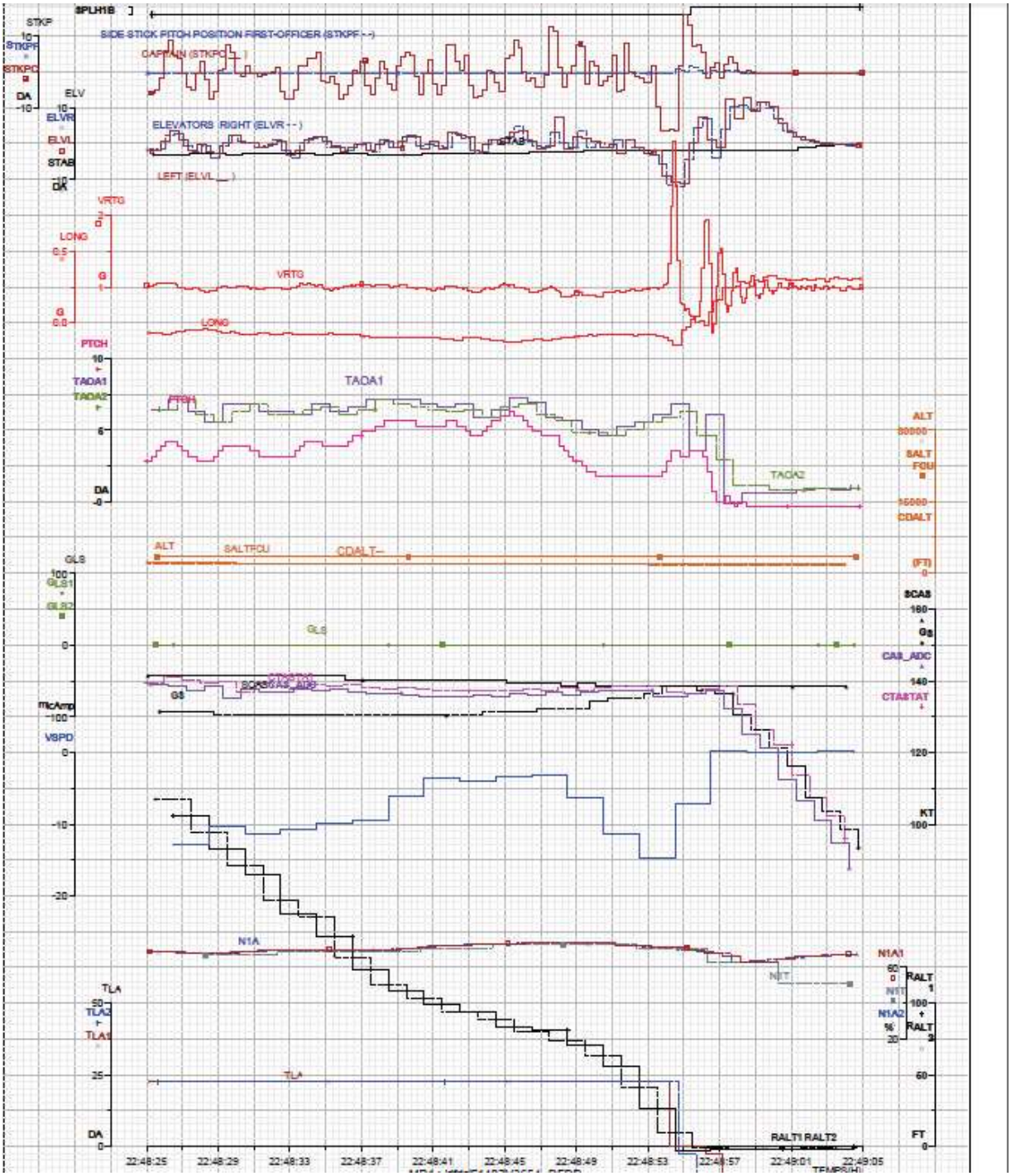


Figure 10: FDR parameters of the landing phase *Source: Airbus*

1.9 Organizational and management information

1.9.1 Operational management

The operator is a new passenger's transport airline in Greece and holds an Air Operator Certificate (AOC) issued by Hellenic Civil Aviation Authority dated 13th of July 2016. The operator's target is to carry out the worldwide operations in ACMI business (Aircraft, Crew, Maintenance, Insurance lease contracts) for at least the three years of the company and covering all remaining available hours with full charter operation on full commitment through the tourist industry.

1.9.2 Stabilized approach

According to data downloaded from DFDR and in accordance with Operator's Flight Crew Operational Manual (FCOM) the final approach of the flight can be categorized as stabilized.

Regulation EU 965/2012, CAT.OP.MPA.300 states:

Approach and landing conditions before commencing an approach to land, the commander must satisfy himself/herself that, according to the information available to him/her, the weather at the aerodrome and the condition of the runway intended to be used should not prevent a safe approach, landing or missed approach, having regard to the performance information contained in the Operations Manual.

In keeping with this regulation the operator in its Flight Crew Operating Manual (FCOM), Chapter Checklist Callouts, subchapter Flight Parameters – Approach, states:

APPROACH

During approach, the PM announces:

- "SPEED" if the speed decreases below the speed target -5 kt or increases above the speed target +10 kt.
- "SINK RATE" when the descent rate exceeds 1 000 ft/min
- "BANK" when bank angle becomes greater than 7 °
- "PITCH" when pitch attitude becomes lower than -2.5 ° or higher than +10 °
- "LOC" or "GLIDE" when either localizer or glide slope deviation is:
  - ½ dot LOC
  - ½ dot GS.
- "CROSS TRACK" when the XTK is greater than 0.1 NM
- "V/DEV" when the vertical deviation is greater than ½ dot
- "COURSE" when greater than ½ dot or 2.5 ° (VOR) or 5 ° (ADF).
- "__ FT HIGH (LOW)" at altitude checks points.

Note: The PM announces the attitude deviations until landing.

Ident.: PRO-NOR-SOP-90-C-00021570.0001001 / 22 MAR 17

Figure 11: FCOM Revision Date: 19.10.2017 *Source: Airline Operator Manual*

1.9.3 Manual Landing

To ensure a safe landing the aircraft must maintain the required configuration, must be aligned with the runway, to land on the centerline and to have a stable approach.

Flight Crew Operating Manual – Standard Operating Procedures-Landing, states:

orange2fly

A318/A319/A320/A321
FLIGHT CREW OPERATING MANUAL

PROCEDURES

NORMAL PROCEDURES

STANDARD OPERATING PROCEDURES - LANDING

MANUAL LANDING

Applicable to: ALL

Ident.: PRO-NOR-SOP-19-A-00010351.0011001 / 25 APR 17

FLARE

The cockpit cut-off angle is 20 °.

- **In stabilized approach conditions, the flare height is approximately 30 ft:**

FLARE..... PERFORM

Avoid flaring high. Refer to Ground Clearance Diagram.

ATTITUDE..... MONITOR

THRUST levers..... IDLE

If autothrust is engaged, it automatically disconnects when the pilot sets both thrust levers to the IDLE detent.

In manual landing conditions, the "RETARD" callout is triggered at 20 ft radio height, in order to remind the pilot to retard the thrust levers.

Note: The ground spoilers extension is inhibited if:
- *Both thrust levers remain above the idle detent, or*
- *One thrust lever is above idle and one thrust lever is at idle detent.*

Figure 12: FCOM, PRO-NOR-SOP 19/ 25 Apr 17 *Source: Airline Operating Manual*

1.9.4 Landing Performance

The Pilots had to take into the consideration also the weather condition that at the time of approach and landing phase. It was snowing and the runway was wet and slushy.

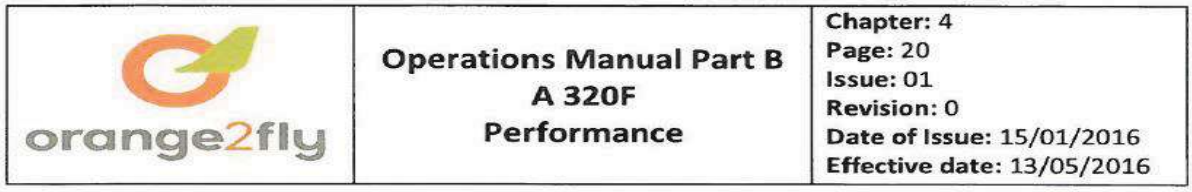
According to Operational Manual Part B, chapter 4 where it states that the landing performance on wet and contaminated runway is affected.

Landing performance including required landing distance shall always be calculated, using the Quick Reference Handbook (QRH) In-flight performance and shall be mentioned during the approach briefing before starting the descent.

In flight failures affecting landing performance and/or required landing distance should always be taken into consideration as well as Wet/Contaminated runway conditions

In case of contaminated runway conditions, the required landing distance is always the greater of:

- WET Required Landing Distance (Actual landing distance demonstrated dry distance x1.67x1.15)
- Actual landing distance considering runway conditions x1.15



4.5.1 Landing field length requirements

The **"Landing Distance"** is the horizontal distance necessary to land and to come to a complete stop from 50 ft. above the runway surface.
The **required "Landing Field Length"** is the demonstrated DRY Landing Distance multiplied by a factor of 1.67.
"Landing field lengths" shown in this manual are based on:

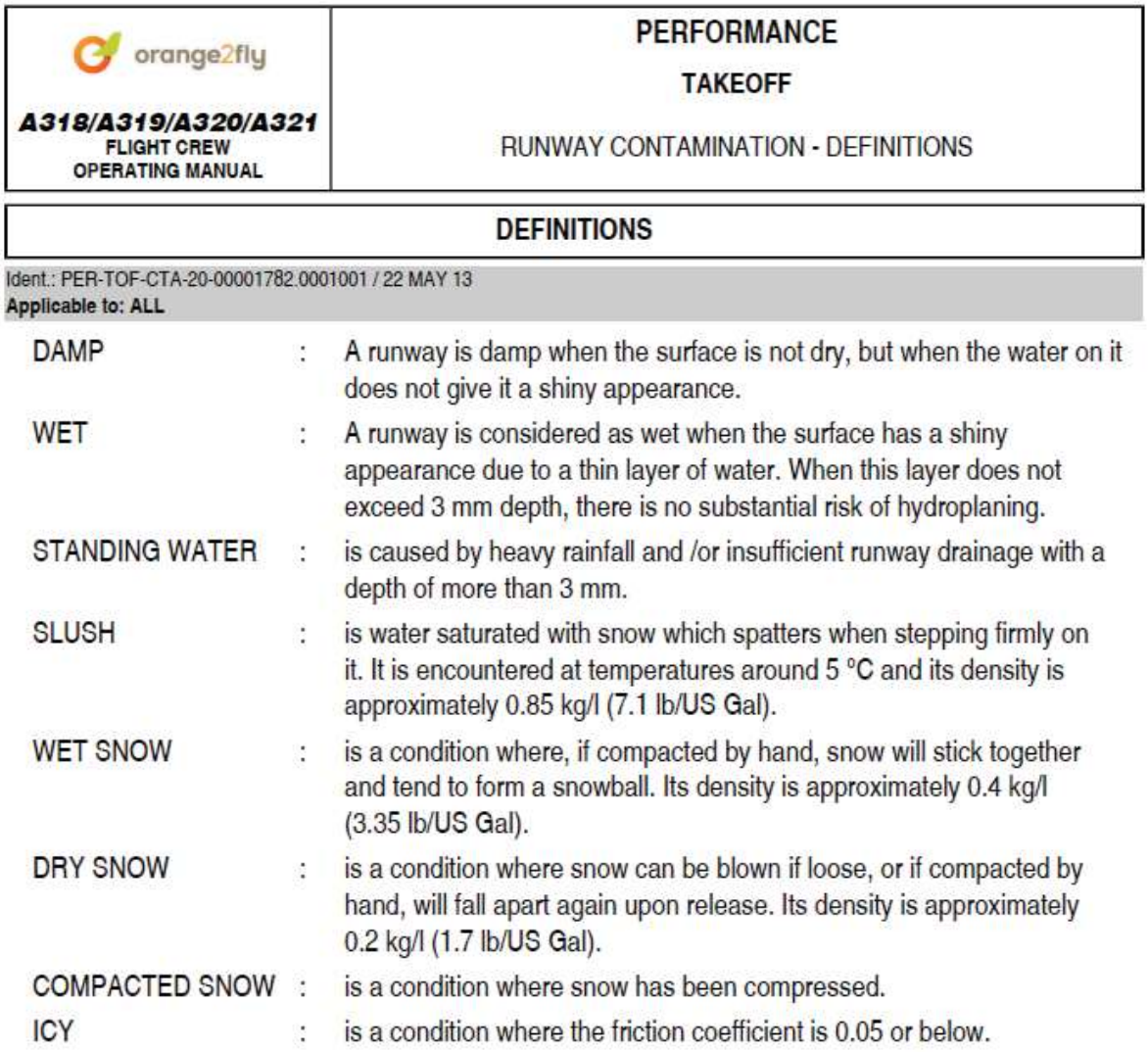
- Achievement at 50 ft. point of the "Threshold speed" VTH (VLS+5);
- Smooth, level, hard surfaced runway;
- Standard day temperature;
- Brakes fully applied and anti-skid operative;
- Ground spoilers extended;
- No thrust reverses.

Wet "Landing field lengths shown on the same chart are determined by multiplying the DRY "Landing field length" by a factor of 1.15
Landing filed length for WET runway condition must be used for dispatching a flight to a destination airport when weather forecasts for landing aerodrome are such that runways are wet or slippery on arrival. For Dry Wet and Contaminated Runway conditions refer to **FPE-IFL-LD**

Figure 13: OM part B on Landing Requirements *Source: Airline Operating Manual*

1.9.5 Runway Contamination

The definitions on contaminated runways can be found in the Flight Crew Operating Manual – Performance –Runway Contamination, where states:



orange2fly

A318/A319/A320/A321
FLIGHT CREW OPERATING MANUAL

PERFORMANCE

TAKEOFF

RUNWAY CONTAMINATION - DEFINITIONS

DEFINITIONS

Ident.: PER-TOF-CTA-20-00001782.0001001 / 22 MAY 13
Applicable to: ALL

DAMP	:	A runway is damp when the surface is not dry, but when the water on it does not give it a shiny appearance.
WET	:	A runway is considered as wet when the surface has a shiny appearance due to a thin layer of water. When this layer does not exceed 3 mm depth, there is no substantial risk of hydroplaning.
STANDING WATER	:	is caused by heavy rainfall and /or insufficient runway drainage with a depth of more than 3 mm.
SLUSH	:	is water saturated with snow which spatters when stepping firmly on it. It is encountered at temperatures around 5 °C and its density is approximately 0.85 kg/l (7.1 lb/US Gal).
WET SNOW	:	is a condition where, if compacted by hand, snow will stick together and tend to form a snowball. Its density is approximately 0.4 kg/l (3.35 lb/US Gal).
DRY SNOW	:	is a condition where snow can be blown if loose, or if compacted by hand, will fall apart again upon release. Its density is approximately 0.2 kg/l (1.7 lb/US Gal).
COMPACTED SNOW	:	is a condition where snow has been compressed.
ICY	:	is a condition where the friction coefficient is 0.05 or below.

Figure 14: Definitions on Contaminated Runway *Source: Airline Operating Manual*

1.9.6 SNOTAM

The SNOTAM Measure Report was provided to AAIIC by the Meteorological Department of Air Navigation Service Agency of Republic of Kosovo. The report measures the deposits over the total runway length and also provides the breaking action on each third of the runway. According to measurement that took place on the 23:01 local there was a WET runway/water patches and the breaking action was good. The pilots were informed accordingly about the condition of the runway.

SNO	(Abbreviated heading)						(LOCATION INDICATOR)					
		S	W	B	K	0167	B	K	P	R	12012301	

(AERODROME LOCATION INDICATOR)	A)	BKPR
(DATE/TIME OF OBSERVATION (Time of completion of measurement in UTC)	B)	12012301
(RUNWAY DESIGNATORS)	C)	17
(CLEARED RUNWAY LENGTH, IF LESS THAN PUBLISHED LENGTH (m))	D)	/
(CLEARED RUNWAY WIDTH, IF LESS THAN PUBLISHED WIDTH (m; if offset left or right of centre line add "L" or "R"))	E)	/
DEPOSITS OVER TOTAL RUNWAY LENGTH (Observed on each third of the runway, starting from threshold having the lower runway designation number) NIL — CLEAR AND DRY 1 — DAMP 2 — WET or water patches 3 — RIME OR FROST COVERED (depth normally less than 1 mm) 4 — DRY SNOW 5 — WET SNOW 6 — SLUSH 7 — ICE 8 — COMPACTED OR ROLLED SNOW 9 — FROZEN RUTS OR RIDGES)		2/2/2
(MEAN DEPTH (mm) FOR EACH THIRD OF TOTAL RUNWAY LENGTH)		
BREAKING ACTION ON EACH THIRD OF RUNWAY AND FRICTION MEASURING EQUIPMENT CALCULATED COEFFICIENT or ESTIMATED SURFACE FRICTION 0.40 and above — GOOD — 5 0.39 to 0.36 — MEDIUM/GOOD — 4 0.35 to 0.30 — MEDIUM — 3 0.29 to 0.26 — MEDIUM/POOR — 2 0.25 and below — POOR — 1 9 — unreliable — UNRELIABLE — 9 (When quoting a measured coefficient, use the observed two figures, followed by the abbreviation of the friction measuring device used. When quoting an estimate, use single digit))	II)	5 5 5 total

Figure 15: Snotam Measurement Report *Source: Meteorological Department*

1.10 Additional Information

1.10.1 General Information on Hard Landings

The definition on hard landing is when the aircraft touches the ground with a greater vertical speed than a normal landing.

To trigger the hard landing the first information comes from the report of the flight crew, where after being suspicious about the landing they report the hard landing.

Also the aircraft today are equipped with software that shows and reports the landing parameters. The software is called AIDS and is centralized system which automatically collects and processes aircraft information. The AIDS generates reports and these reports are results of related AIDS monitored aircraft systems. Also these reports can be requested manually or started automatically.

Collected monitored aircraft data are automatically supplied to related systems during unusual aircraft operation. The automatic modes for printing and ACARS are fully customizable by each operator, for both triggering thresholds and logic. These may be changed at the Operators discretions.

The monitor functions have fixed trigger mechanisms, fixed data collection and output formatting. The output of data is done by the Data Management Unit (DMU).

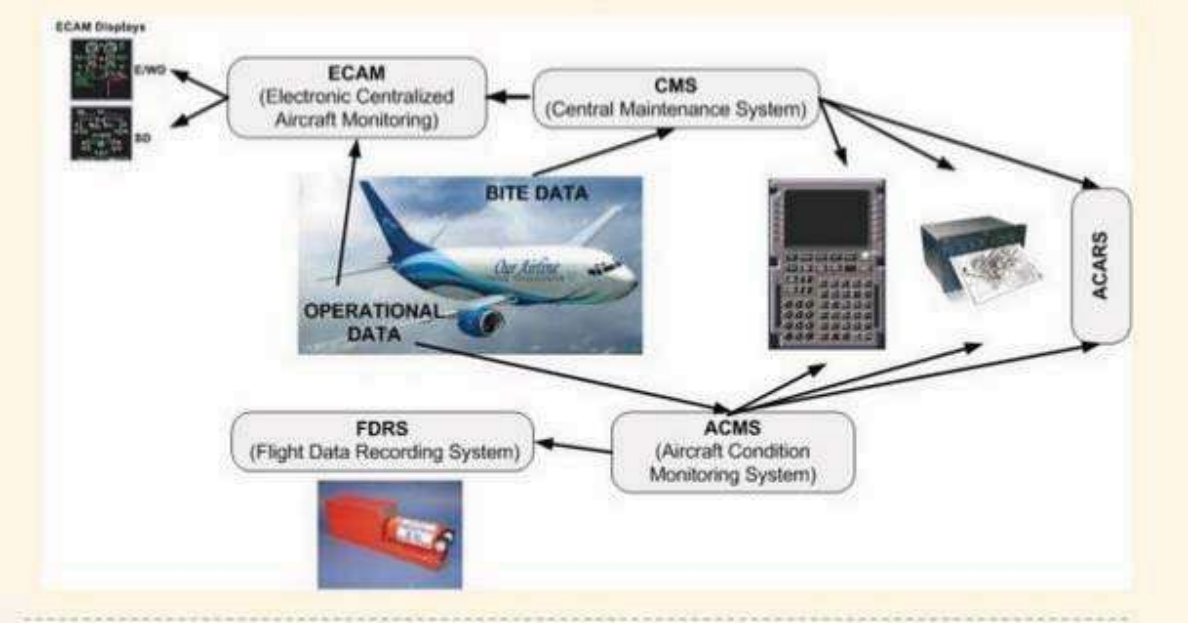


Figure 16: how the data are acquired in the aircraft *Source: Internet/researchgate.net*

1.10.2 Data Management Unit (DMU)

The DMU is part of the Aircraft Integrated Data System (AIDS). In addition of automatic generation of reports, when a report is requested manually with the remote print button, it is generated immediately and independently of any other start based logic.

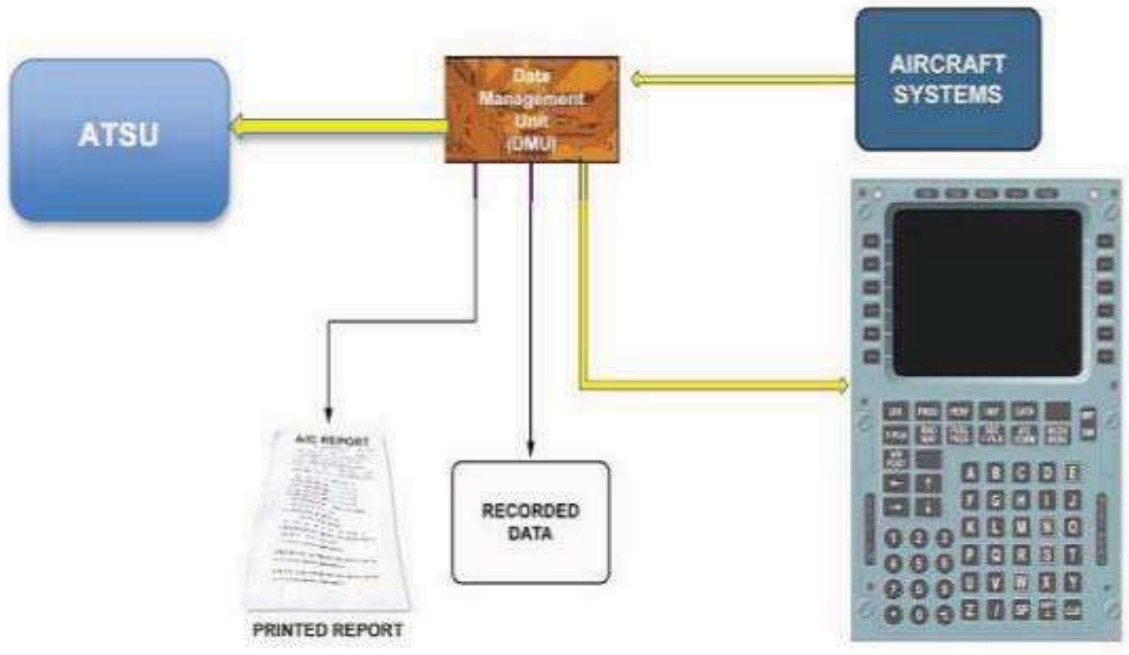


Figure 17: Function of the DMU *Source: BEA*

In the DMU are many parameters that are stored and ready for display monitoring and recording depending on what report is requested upon report activation. The criteria what to display in the DMU are defined by the operator and the manufacturer.

The automatic printout is programmable by the Operators, for the case of the incident the following parameters were set in the aircraft on how to get the AIDS DMU programming print.

From the AMM task 31-36-00-740-016 A Flight Data Interface and Management Unit (FDIMU) Programming Procedures. Subtask 31-36-00-740-076-A B. Programmable Report Inhibit. Click the PRINT* prompt (on MCDU LS Key 6R).

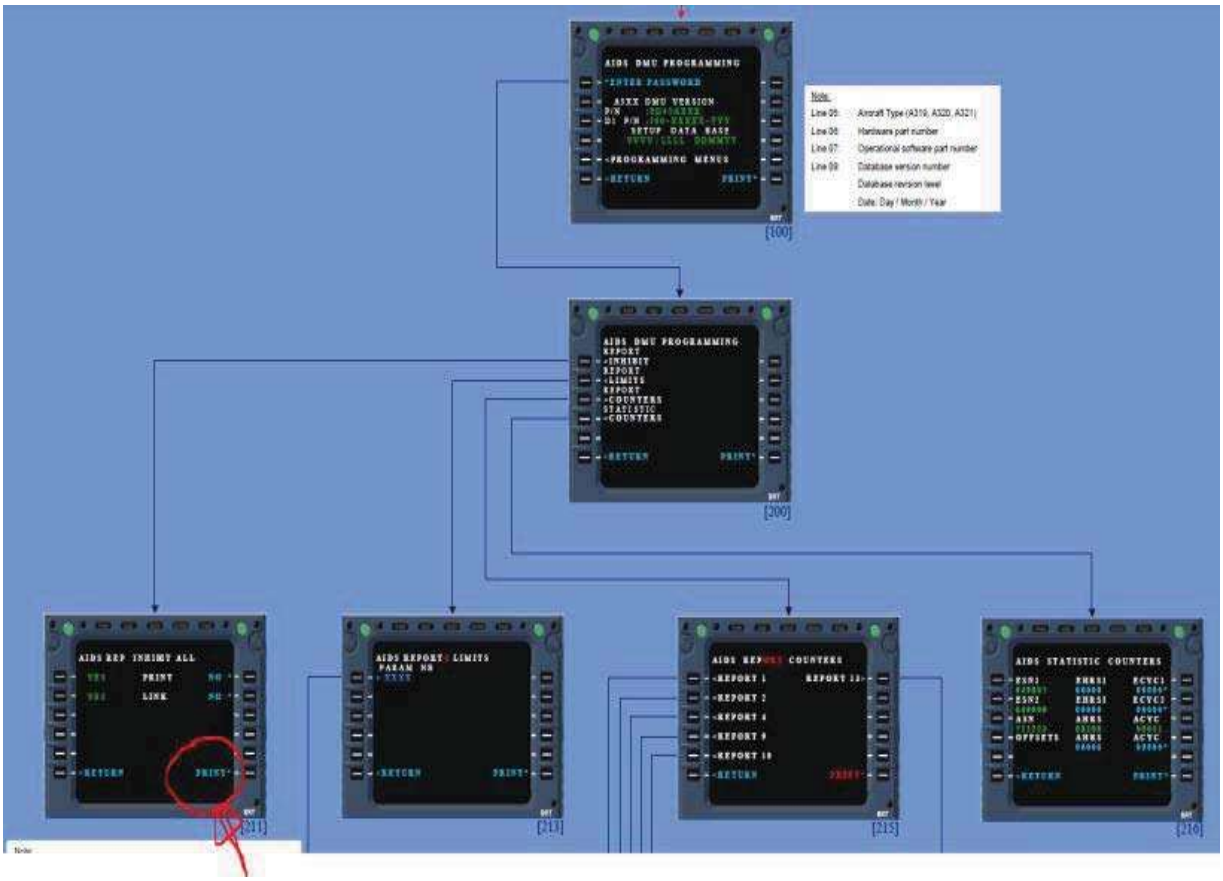


Figure 18: The Printout procedures on DMU *Source: Airbus*

The DMU collects the parameters specific to that report. After the data are generated the report may be printed on the flight deck, copied to DAR/SAR or sent directly to the operator through Aircraft Communication Addressing and Reporting System (ACARS) system.

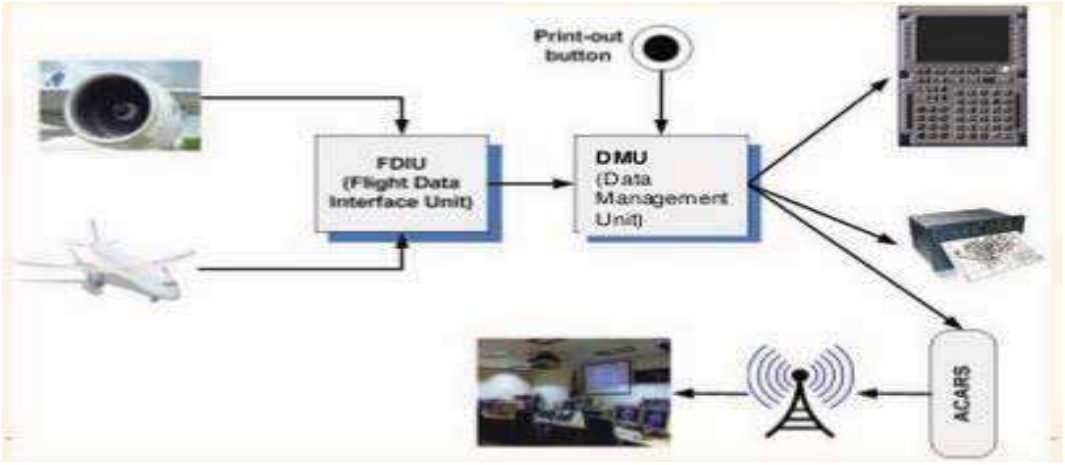


Figure 19: How data is handled and stored in the DMU *Source: Internet/researchgate.net*

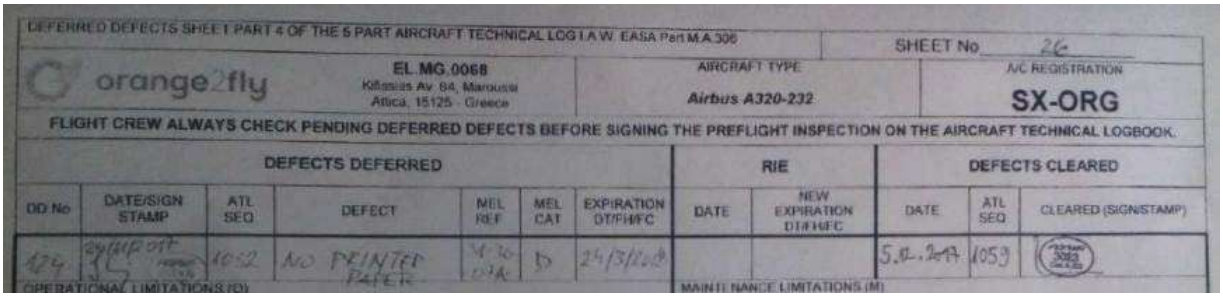
During the Basel – Pristina flight on 1st of December and the 8 consecutive back and forth flights after the incident, there was a missing paper in the DMU therefor no automatic printout of Load Report<15> occurred, and there is no ACARS system integrated to the operator for automatic data transfer to their facilities also according to flight crew there were no any indications shown on ECAM.

1.10.3 Maintenance Organization

The operator has a total component support agreement and heavy maintenance agreement with Lufthansa Technik with a Service Level Agreement (SLA) which guarantees that within 3 hours LHT will deliver spare parts within EU.

In the Pristina International Airport the operator doesn't have their own maintenance for daily checks and maintenance, for this purpose the operator has an agreement with the company ADRIA for daily inspections and maintenance.

The ADRIA technicians have reported on the Operators Technical Log Book that, there is no Printer Paper in the DMU, this report is dated on 24th of November 2017. The paper was installed on 5th of December 2017 the day when the Load Report <15> was generated and the same day the aircraft was grounded in the Pristina International Airport. To the AAIIC the work order of the missing paper in the DMU had been provided by the ADRIA technicians on date 12.26.2017.



DEFERRED DEFECTS SHEET PART 4 OF THE 5 PART AIRCRAFT TECHNICAL LOG I.A.W. EASA Part M.A.306 — SHEET No 26

orange2fly — EL.MG.0068, Kifissias Av. 84, Marousi, Attica, 15125 - Greece — AIRCRAFT TYPE: Airbus A320-232 — A/C REGISTRATION: SX-ORG

FLIGHT CREW ALWAYS CHECK PENDING DEFERRED DEFECTS BEFORE SIGNING THE PREFLIGHT INSPECTION ON THE AIRCRAFT TECHNICAL LOGBOOK.

DEFECTS DEFERRED							RIE		DEFECTS CLEARED		
DD No	DATE/SIGN STAMP	ATL SEQ	DEFECT	MEL REF	MEL CAT	EXPIRATION DT/FH/FC	DATE	NEW EXPIRATION DT/FH/FC	DATE	ATL SEQ	CLEARED (SIGN/STAMP)
124	[illegible]	1052	NO PRINTER PAPER	[illegible]	D	24/3/2018			5.12.2017	1053	[illegible]

OPERATIONAL LIMITATIONS (D) — MAINTENANCE LIMITATIONS (M)

Figure 20: Operators Technical Log Book *Source: Operator*

1.10.4 Load Report <15>

As mentioned in the above chapters the aircraft A320 have an Integrated Data System that is called AIDS. This system receives information from many other systems through its DMU. The DMU then processes this data and produces reports based on various parameters. The report generated that identifies the hard landings is called Load <15> report. This report will be produced automatically if any of the following conditions are met:

- The vertical acceleration (VRTA) is higher than 2.6 g (at +/-5 seconds) during the landing and after.

- The radio altimeter descent rate (RALR) is greater than 9ft/sec during the landing (at +/- 5seconds)
- When the aircraft gross weight (GW) is higher than the maximum landing gross weight (GWL) and the radio altimeter descent rate is less 6ft/sec.
- When the aircraft gross weight (GW) is higher than the maximum landing gross weight (GWL) and vertical acceleration (VRTA) is higher than 1.7 g.
- For a bounced landing the vertical acceleration (VRTA) is higher than 2.6 g (at +/- 5 seconds) during the landing.

The Load <15> report is a structural exceedence report to identify if a hard landing has occurred, if so to ensure appropriate checks and inspections followed by AMM reference.

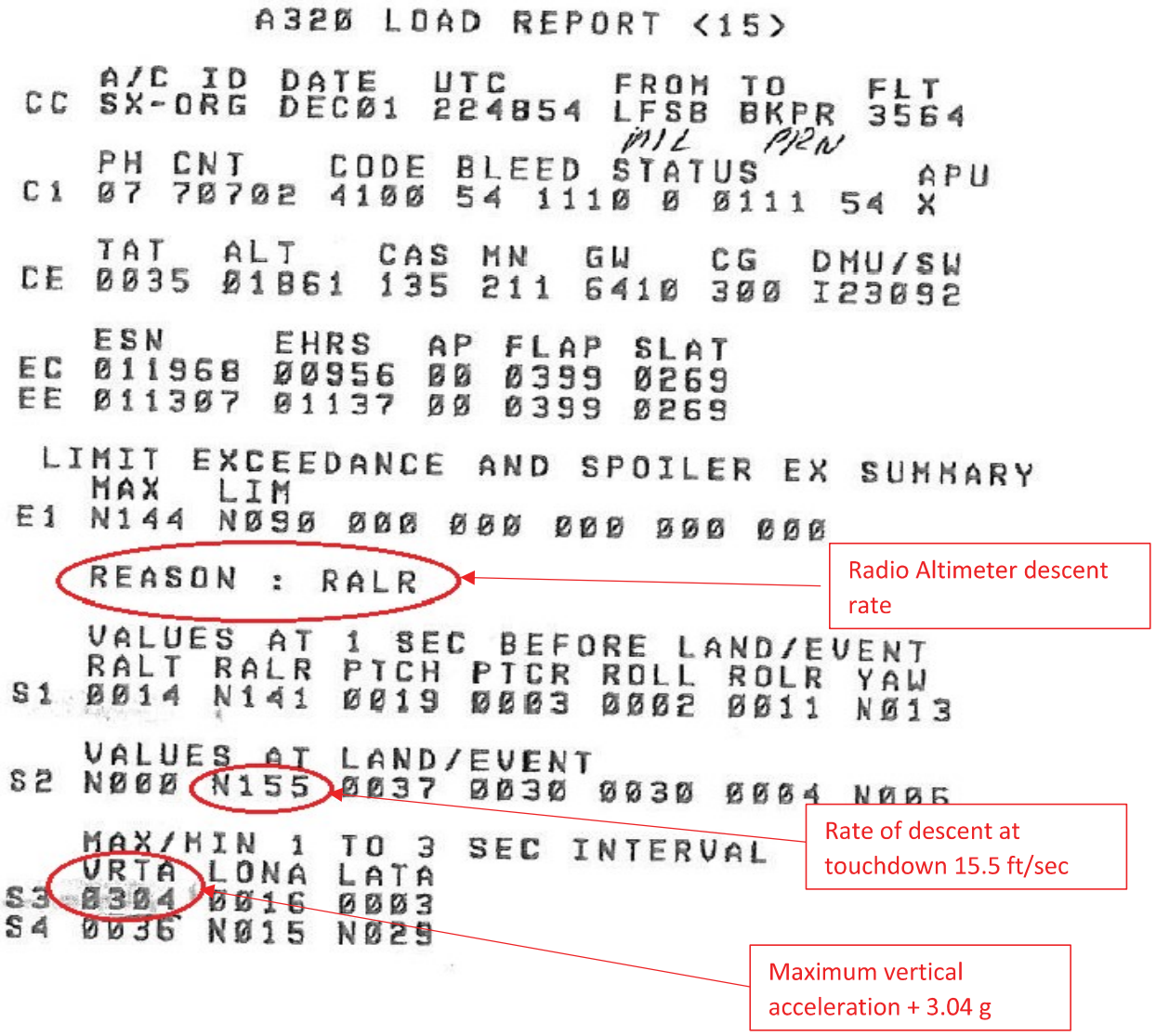


Figure 21: Load <15> report *Source: Operator*

After the occurrence of the hard landing there are some specific tasks to be carried out according to Approved Maintenance Manual 05-51-11-200-004 where it states:

"it is the responsibility of the flight crew to make a report if they think there was a hard/overweight landing."

Also states that:

" after a crew report of a hard/overweight landing, you must confirm the impact parameters to know the category of the landing. To know this, refer to: - the DMU load report 15 or - the FDRS read out."

The specific inspections with the steps for a severe hard landing need to be carried out to the aircraft by the engineers after the exceedance of parameters.

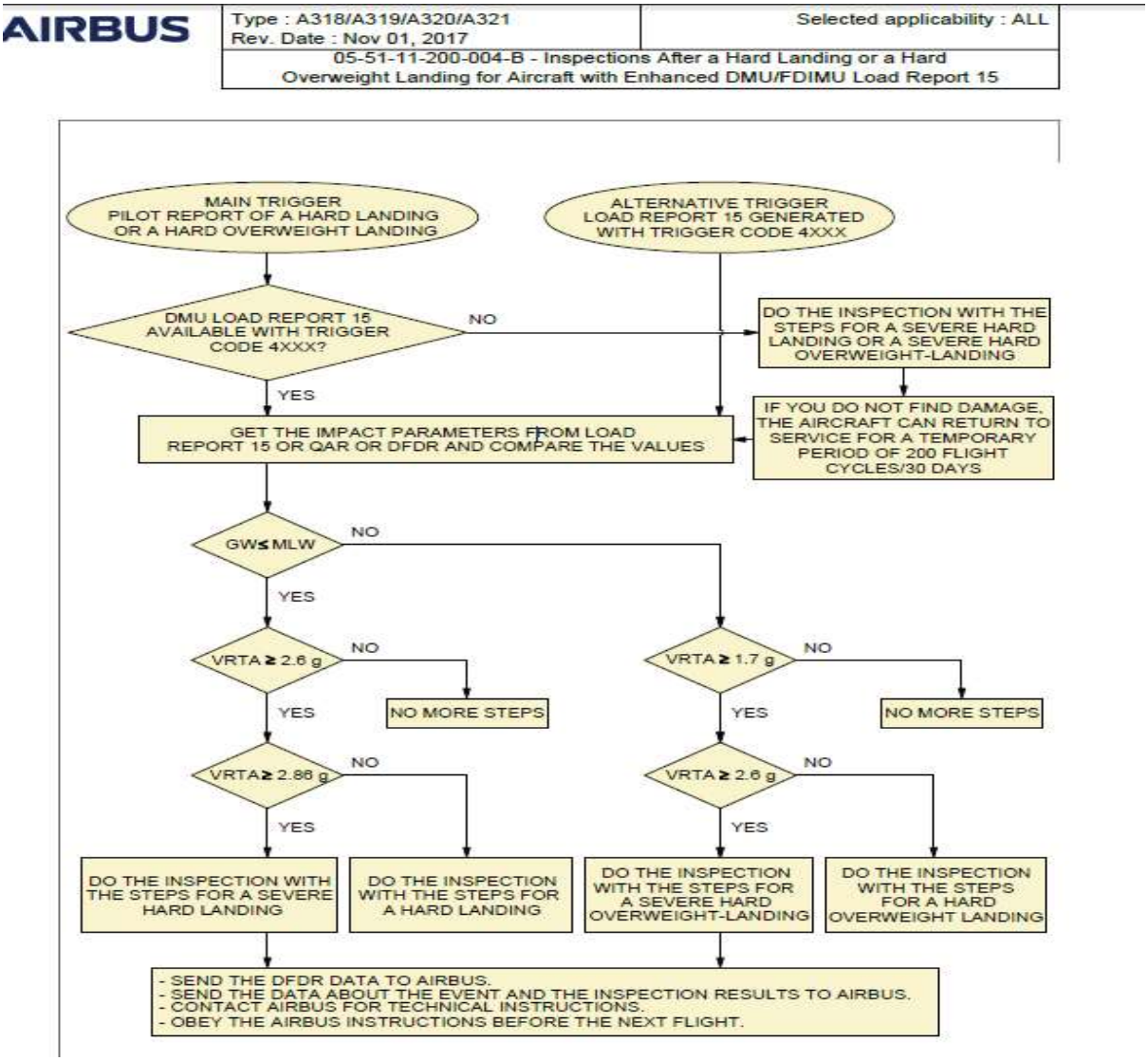


Figure 22: Hard Landing Inspections Chart *Source: Airbus*

1.10.5 Minimum Equipment List (MEL)

1.10.5.1 Definitions

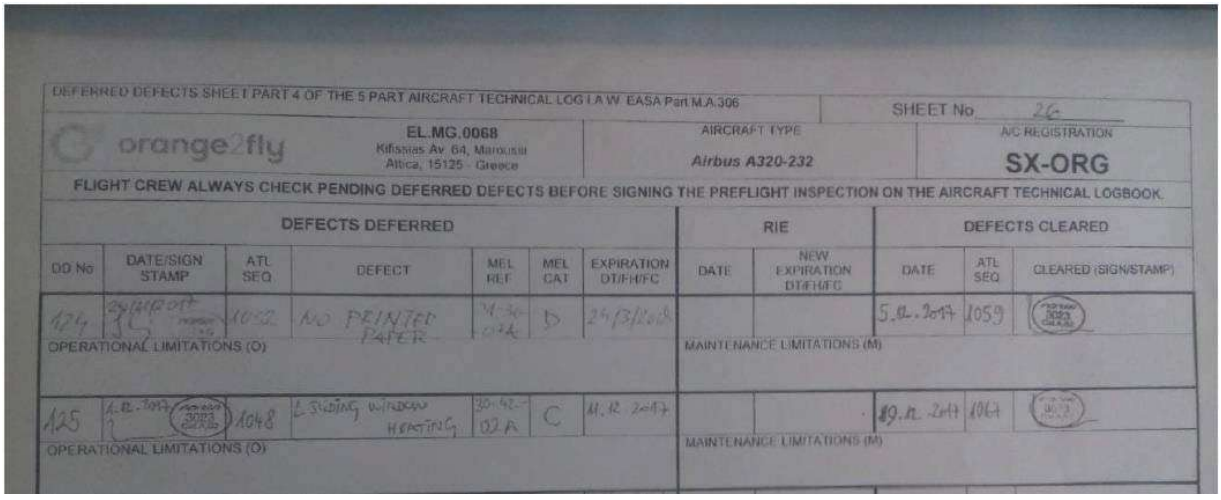
For the operation of the aircraft, specific conditions of the flight, or with particular equipment inoperative, the operator has to have a Minimum Equipment List. MEL is a list and has to be in conformity or more restrictive than the Master Minimum Equipment List (MMEL) established for the aircraft type (ICAO Annex 6: Operation of Aircraft).

Master Minimum Equipment List (MMEL) is a list established for a particular aircraft type by the organization responsible for the type design with the approval of the State of Design which identifies items which individually may be unserviceable at the commencement of a flight.

The operator shall include in the operations manual a minimum equipment list (MEL), approved by the State of the Operator which will enable the pilot-in-command to determine whether a flight may be commenced or continued from any intermediate stop should any instrument, equipment or systems become inoperative.

According to operator's MEL, the missing paper in the DMU was categorized as MEL item Cat D. Category D means the Repair interval shall be rectified within 120 consecutive calendar days, excluding the day of discovery.

The figure shows aircraft maintenance log book.

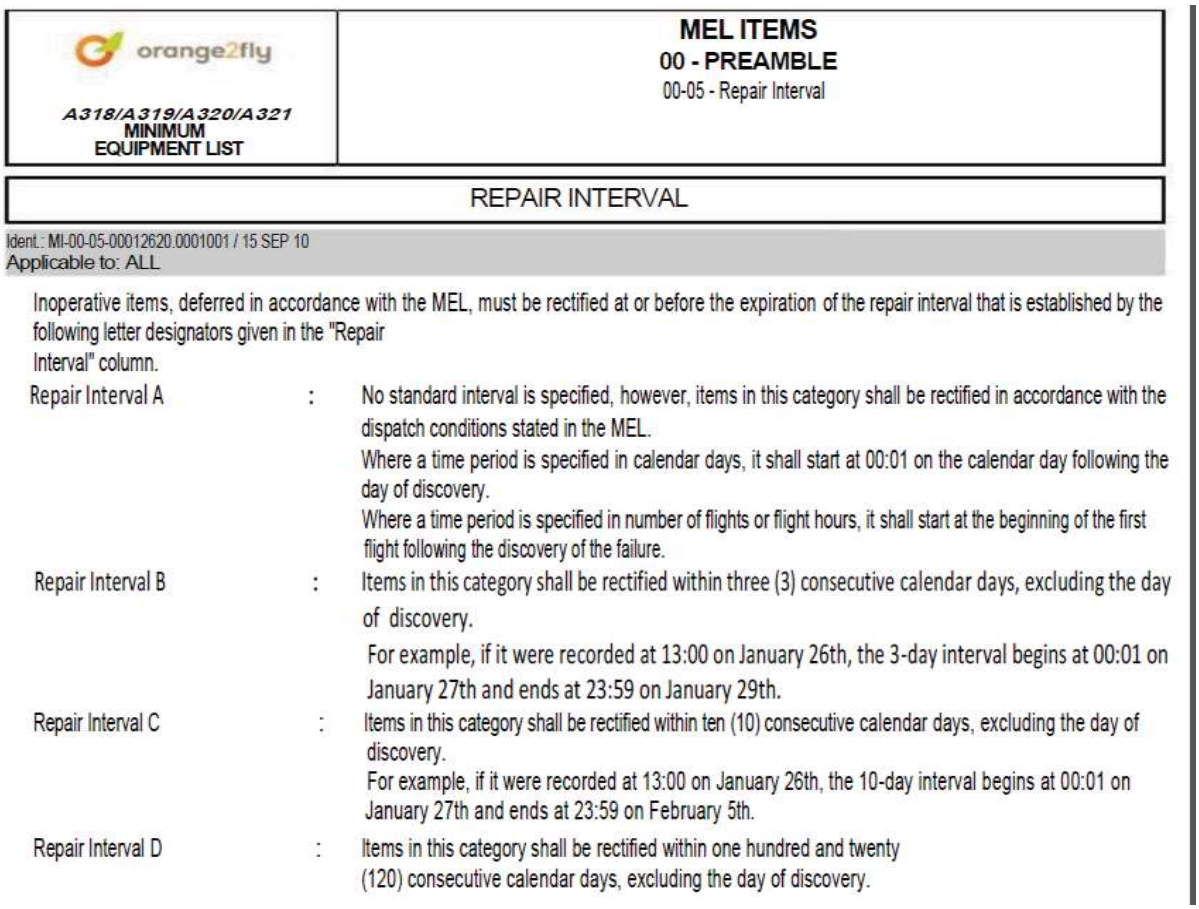


DEFERRED DEFECTS SHEET PART 4 OF THE 5 PART AIRCRAFT TECHNICAL LOG I.A.W. EASA Part M.A.306 — SHEET No 26

orange2fly — EL.MG.0068, Kifissias Av. 64, Marousi, Attica, 15125 - Greece — AIRCRAFT TYPE: Airbus A320-232 — A/C REGISTRATION: SX-ORG

FLIGHT CREW ALWAYS CHECK PENDING DEFERRED DEFECTS BEFORE SIGNING THE PREFLIGHT INSPECTION ON THE AIRCRAFT TECHNICAL LOGBOOK

DEFECTS DEFERRED							RIE		DEFECTS CLEARED		
DD No	DATE/SIGN STAMP	ATL SEQ	DEFECT	MEL REF	MEL CAT	EXPIRATION DT/FH/FC	DATE	NEW EXPIRATION DT/FH/FC	DATE	ATL SEQ	CLEARED (SIGN/STAMP)
124	[illegible]	1052	NO PRINTED PAPER	[illegible]	D	[illegible]			5.12.2017	1059	
OPERATIONAL LIMITATIONS (O)							MAINTENANCE LIMITATIONS (M)				
125	1.12.2017	1048	L SLIDING WINDOW HEATING	30-42-02 A	C	31.12.2017			19.12.2017	1067	
OPERATIONAL LIMITATIONS (O)							MAINTENANCE LIMITATIONS (M)				



orange2fly

A318/A319/A320/A321
MINIMUM
EQUIPMENT LIST

MEL ITEMS
00 - PREAMBLE
00-05 - Repair Interval

REPAIR INTERVAL

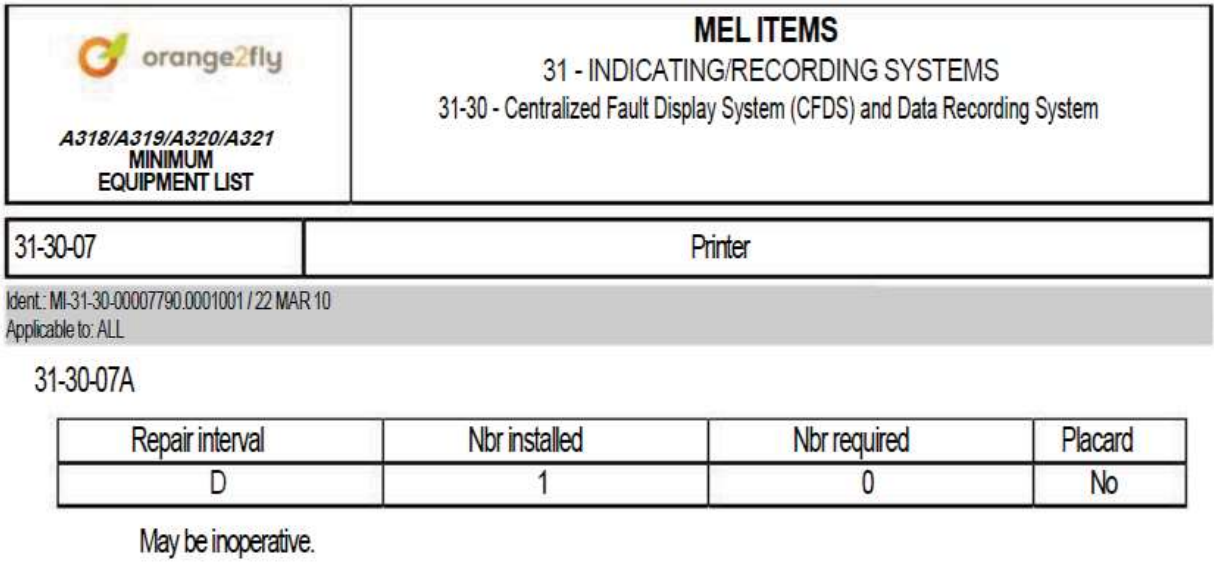
Ident.: MI-00-05-00012620.0001001 / 15 SEP 10
Applicable to: ALL

Inoperative items, deferred in accordance with the MEL, must be rectified at or before the expiration of the repair interval that is established by the following letter designators given in the "Repair Interval" column.

Repair Interval A	:	No standard interval is specified, however, items in this category shall be rectified in accordance with the dispatch conditions stated in the MEL. Where a time period is specified in calendar days, it shall start at 00:01 on the calendar day following the day of discovery. Where a time period is specified in number of flights or flight hours, it shall start at the beginning of the first flight following the discovery of the failure.
Repair Interval B	:	Items in this category shall be rectified within three (3) consecutive calendar days, excluding the day of discovery. For example, if it were recorded at 13:00 on January 26th, the 3-day interval begins at 00:01 on January 27th and ends at 23:59 on January 29th.
Repair Interval C	:	Items in this category shall be rectified within ten (10) consecutive calendar days, excluding the day of discovery. For example, if it were recorded at 13:00 on January 26th, the 10-day interval begins at 00:01 on January 27th and ends at 23:59 on February 5th.
Repair Interval D	:	Items in this category shall be rectified within one hundred and twenty (120) consecutive calendar days, excluding the day of discovery.

Figure 23: Repair Interval according to operator's MEL *Source: Operator*

The flight crew and the maintenance staff were aware about the missing paper in the printer.



orange2fly

A318/A319/A320/A321
MINIMUM
EQUIPMENT LIST

MEL ITEMS
31 - INDICATING/RECORDING SYSTEMS
31-30 - Centralized Fault Display System (CFDS) and Data Recording System

31-30-07	Printer

Ident.: MI-31-30-00007790.0001001 / 22 MAR 10
Applicable to: ALL

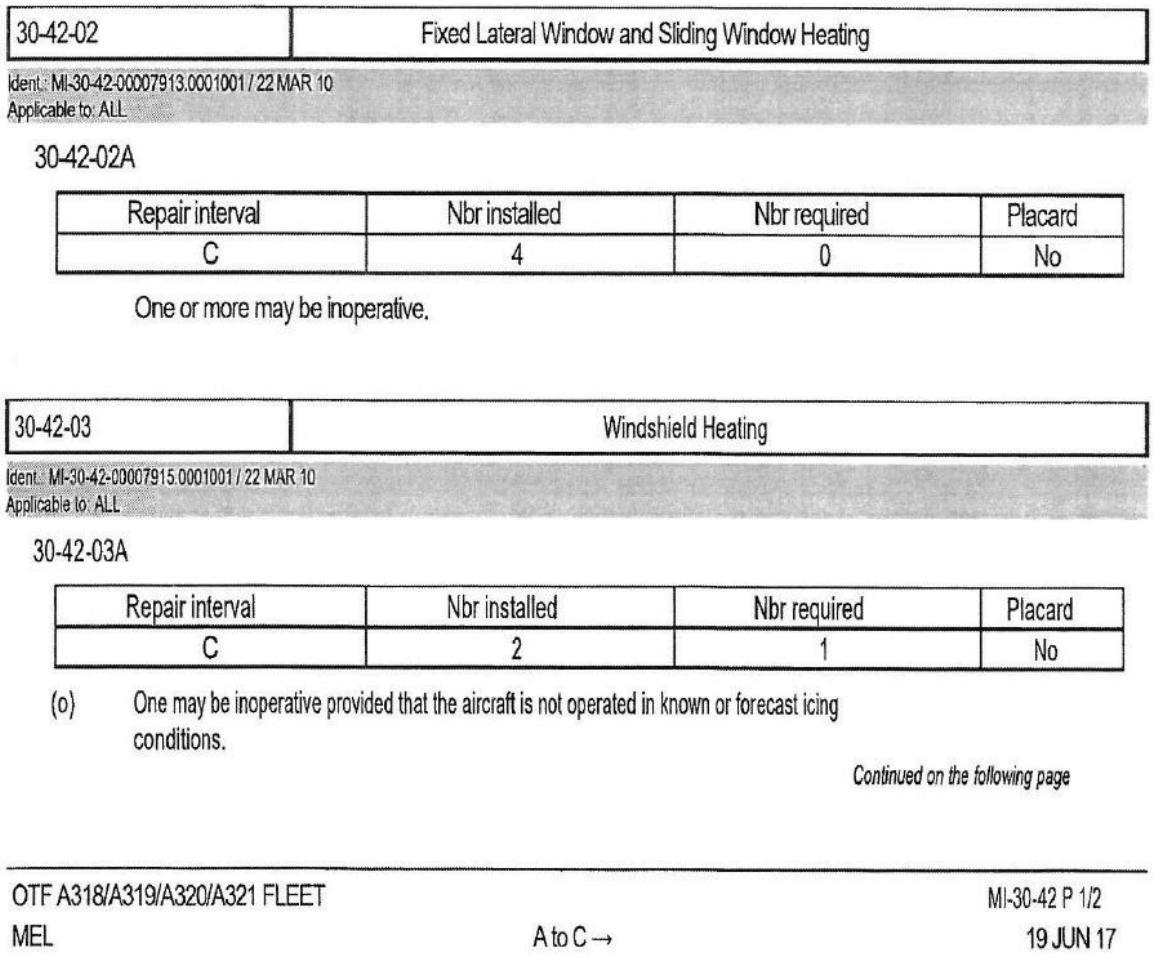
31-30-07A

Repair interval	Nbr installed	Nbr required	Placard
D	1	0	No

May be inoperative.

Figure 24: MEL item category D – Printer *Source: Operator*

The flight crew and the maintenance staff were aware about LH captain window was out of order and was an MEL item.



30-42-02	Fixed Lateral Window and Sliding Window Heating

Ident: MI-30-42-00007913.0001001 / 22 MAR 10
Applicable to: ALL

30-42-02A

Repair interval	Nbr installed	Nbr required	Placard
C	4	0	No

One or more may be inoperative.

30-42-03	Windshield Heating

Ident: MI-30-42-00007915.0001001 / 22 MAR 10
Applicable to: ALL

30-42-03A

Repair interval	Nbr installed	Nbr required	Placard
C	2	1	No

(o) One may be inoperative provided that the aircraft is not operated in known or forecast icing conditions.

Continued on the following page

Figure 25: MEL item category C – Window Heating *Source: Operator*

1.11 Aircraft examination

After the event the aircraft was grounded at Pristina airport for further inspections. The maintenance engineers could not perform a complete AMM 05-51-11 inspection due to lack of aircraft jacking facilities on location. The items that need to be inspected via aircraft on jacks are: **Inspection of Nose landing gear and Inspection of the MLG.**

The operator requested a ferry flight to suitable maintenance facility to carry out further maintenance actions related to the event.

Before an approval by the manufacturer for the ferry flight, there are certain aircraft structure inspections that need to take in place in order the ferry flight be allowed. Inspections were performed on the aircraft with nil findings. The ferry flight was conducted with the following conditions/restrictions according to Airbus – Flight Conditions for a Permit to Fly with the approval number 80392630/089/2017-1

- The aircraft should be operated at the lowest possible weight
- Fuel load shall be limited to the quantity necessary to perform the intended leg
- Only the crew members in charge of the flight should be on board
- Zero payload as per weight and balance manual
- The aircraft is permitted to perform 2 (two) “zero payload” flight cycles with the Landing Gears down and locked

At the maintenance facilities, the AMM 05-51-11 jacked inspections of the nose landing gear and main landing gear were completed with NIL findings. Also detailed structure inspections programme issue 3 has been completed with NIL findings. The structure inspections were as follows:

AIRBUS Customer Services	Engineering Severe Hard Landing	Dossier Reference: 80392630
		Creation date dossier: 06-DEC-2017

III. **LANDING GEARS** (message ref. 80392630/130)

1. NLG can be returned to service with no further action required.
2. LH MLG can be returned to service, provided that AMM 05-51-11 "Severe Hard Landing" inspections has been completed with NIL findings
3. RH MLG can be returned to service provided that :

   3.1. RH MLG shock absorber assembly (excluding RH MLG sliding tube) including all internal shock absorber components are considered to be un-serviceable and must be replaced prior to next flight. RH MLG unserviceable components must be scrapped by component mutilation.

   3.2. AMM 05-51-11 "Severe Hard Landing" inspections has been completed with NIL findings.

Wheels, Axle Sleeves, Brakes and Tyres:

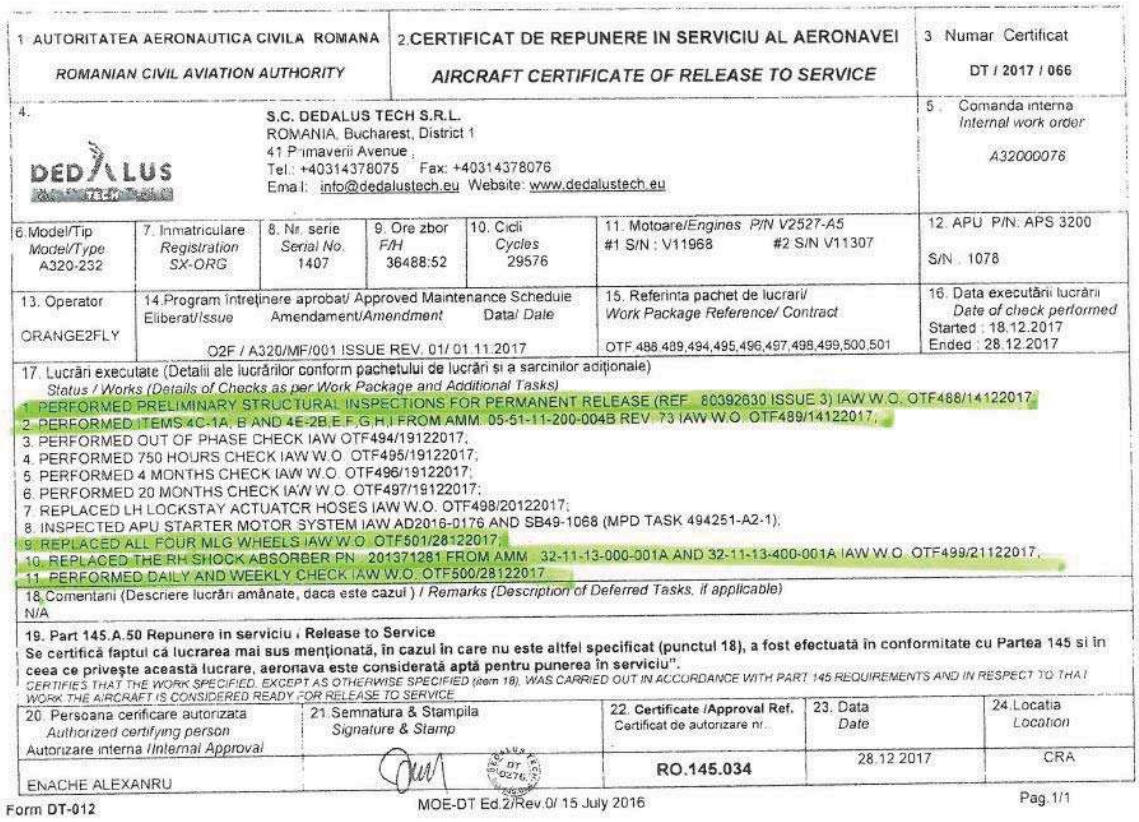
1. The RH and LH MLG tires has been inspected as per Tire Care and Service manual (or AMM task 32-41-00-210-002) with NIL findings.
2. The RH and LH MLG Axle Sleeves can be returned into service without any further investigation.
3. The RH and LH MLG brakes can be returned into service without any further investigation.
4. If brake fans are installed, LH and RH MLG brake fans have been functionally tested as per AMM 32-48-00-720-001 before being returned back into service.
5. The NLG wheels, tires and axle sleeves can be returned into service without any further investigation

NOTE: Further to an additional review, we would like to advise that RH and LH MLG wheels do not need to be removed from aircraft and inspected as per wheel CMM (as previously recommended in message /130). RH and LH MLG wheels involved in the event can be returned into service without any further investigation.

Figure 26: Airbus Final Recommendation for Return to Service *Source: Airbus*

Following the inspections the operator requested initially to Airbus that all four wheels on the Main Landing Gear Wheels (MLG) and Rear Shock Absorber (RH) to be replaced. Airbus Ref: 80392630_133 issued, stated that there is no need to remove the wheels, but still the operator made the changes of all main wheels and as was initially requested the Rear Shock Absorber (RH) were replaced as well.

The maintenance company made the requested changes and on 28th of December 2017 released the aircraft back to service followed with aircraft certificate of release to service.



1. AUTORITATEA AERONAUTICA CIVILA ROMANA *ROMANIAN CIVIL AVIATION AUTHORITY*	2. CERTIFICAT DE REPUNERE IN SERVICIU AL AERONAVEI *AIRCRAFT CERTIFICATE OF RELEASE TO SERVICE*	3. Numar Certificat DT / 2017 / 066

4.		5. Comanda interna *Internal work order*
DEDALUS	S.C. DEDALUS TECH S.R.L. ROMANIA, Bucharest, District 1 41 Primaverii Avenue , Tel.: +40314378075 Fax: +40314378076 Email: info@dedalustech.eu Website: www.dedalustech.eu	A32000076

6. Model/Tip *Model/Type* A320-232	7. Inmatriculare *Registration* SX-ORG	8. Nr. serie *Serial No.* 1407	9. Ore zbor *F/H* 36488:52	10. Cicli *Cycles* 29576	11. Motoare/*Engines P/N V2527-A5* #1 S/N : V11968 #2 S/N V11307	12. APU P/N: APS 3200 S/N . 1078
13. Operator ORANGE2FLY	14. Program întreținere aprobat/ Approved Maintenance Schedule Eliberat/*Issue* Amendament/*Amendment* Data/ *Date* O2F / A320/MF/001 ISSUE REV. 01/ 01.11.2017				15. Referinta pachet de lucrari/ *Work Package Reference/ Contract* OTF.488,489,494,495,496,497,498,499,500,501	16. Data executării lucrării *Date of check performed* Started : 18.12.2017 Ended : 28.12.2017

17. Lucrări executate (Detalii ale lucrărilor conform pachetului de lucrări și a sarcinilor adiționale)
Status / Works (Details of Checks as per Work Package and Additional Tasks)

1. PERFORMED PRELIMINARY STRUCTURAL INSPECTIONS FOR PERMANENT RELEASE (REF. 80392630 ISSUE 3) IAW W.O. OTF488/14122017;
2. PERFORMED ITEMS 4C-1A, B AND 4E-2B,E,F,G,H,I FROM AMM. 05-51-11-200-004B REV. 73 IAW W.O. OTF489/14122017;
3. PERFORMED OUT OF PHASE CHECK IAW OTF494/19122017;
4. PERFORMED 750 HOURS CHECK IAW W.O. OTF495/19122017;
5. PERFORMED 4 MONTHS CHECK IAW W.O. OTF496/19122017;
6. PERFORMED 20 MONTHS CHECK IAW W.O. OTF497/19122017;
7. REPLACED LH LOCKSTAY ACTUATOR HOSES IAW W.O. OTF498/20122017;
8. INSPECTED APU STARTER MOTOR SYSTEM IAW AD2016-0176 AND SB49-1068 (MPD TASK 494251-A2-1);
9. REPLACED ALL FOUR MLG WHEELS IAW W.O. OTF501/28122017;
10. REPLACED THE RH SHOCK ABSORBER PN : 201371281 FROM AMM 32-11-13-000-001A AND 32-11-13-400-001A IAW W.O. OTF499/21122017;
11. PERFORMED DAILY AND WEEKLY CHECK IAW W.O. OTF500/28122017.

18. Comentarii (Descriere lucrări amânate, daca este cazul) / *Remarks (Description of Deferred Tasks, if applicable)*
N/A

19. Part 145.A.50 Repunere in serviciu / Release to Service
Se certifică faptul că lucrarea mai sus menționată, în cazul în care nu este altfel specificat (punctul 18), a fost efectuată în conformitate cu Partea 145 și în ceea ce privește această lucrare, aeronava este considerată aptă pentru punerea în serviciu".
CERTIFIES THAT THE WORK SPECIFIED, EXCEPT AS OTHERWISE SPECIFIED (item 18), WAS CARRIED OUT IN ACCORDANCE WITH PART 145 REQUIREMENTS AND IN RESPECT TO THAT WORK THE AIRCRAFT IS CONSIDERED READY FOR RELEASE TO SERVICE.

20. Persoana cerificare autorizata *Authorized certifying person* Autorizare interna /*Internal Approval*	21. Semnatura & Stampila *Signature & Stamp*	22. Certificate /Approval Ref. Certificat de autorizare nr.	23. Data *Date*	24. Locatia *Location*
ENACHE ALEXANRU		RO.145.034	28.12.2017	CRA

Form DT-012 MOE-DT Ed.2/Rev.0/ 15 July 2016 Pag.1/1

Figure 27: Aircraft Certificate of Release to Service *Source: Operator*

2. Analysis

2.1 Summary

The flight crew was qualified in accordance with the regulations, also there were no indications for any failure of the aircraft that contributed to this event. The left side window of the PF was foggy and was out of order because the heating was not working and the captain had reduced peripheral view. This malfunction was an MEL item and did not had an impact on the perception of the PF and was not the cause of the incident.

The weather conditions and the Captain maneuver for aiming a Positive Landing can be considered as a contributing factors to this incident.

The analysis will focus from the moment of AP disengagement till the final seconds of the landing more precisely from 500 ft to touchdown.

2.2 Flight Planning and briefing

The landing was planned to take place on the Runway 35, with a non-precision VOR-DME approach. Regarding the characteristics of the runway and the terrain the operator had decided that only the PF will do the landings in the Pristina Airport.

The flight crew received the SNOTAM from the ATC 18 minutes before the event occurred. There was a briefing between the flight crew before the approach, and, because of weather conditions, they decided to aim for a positive landing due to snow and wet runway. The PM did callouts and declared a stabilized approach.

2.3 Activities during approach till touchdown

From the moment the AP was disengaged at around 2000 ft the aircraft was in landing configuration and was handled by PF. Both FD's and Final app mode were disengaged as a consequence of VOR DME 35 Missed Approach Point.

At 500 ft the right turn started so the aircraft to be aligned with the runway. The PF aligned the aircraft with runway axis, consequently the roll angle was increased up to +10 ^{0}, before being reduced.

The Digital Flight Data Recorder (DFDR) showed that seconds after crossing 500 ft the aircraft made unusual nose up and nose down orders. The pitch angle increased from +2 ^{0} to +6 ^{0} (nose up) and the rate of descent decreased from 770 ft/min to 200 ft/min.

Three significant forward stick inputs applied by PF in the continuation, these orders decreased the pitch angle from +6 ^{0} to +2 ^{0} and the rate of descent increased from 200 ft/min to 880 ft/min.

At 20 ft RA the PF applied a full back stick input which lead to increasing the pitch angle from +2 ^{0} to +3.5 ^{0} and increase of vertical load factor from + 0.96 G to +1.05 G.

This pitch-control input was applied at very low altitude and the vertical speed did not decrease sufficiently, remaining at 880 ft/min. The aircraft touched down at 3.04 G which is considered to be a “Severe Hard Landing

2.4 The Heavy Landing Reporting

The aircraft continued to fly on 8 more sectors after the hard landing occurred, on 6th of December the aircraft was declared AOG (Aircraft on the Ground). The heavy landing reporting is crucial for taking actions to ensure that the aircraft remains functional and in airworthiness condition. According to manufacturer manual where it states that reporting of high load events must come from the pilot’s experience and awareness as first detection. It is the responsibility of every pilot to report high load occurrence by entering it the logbook. This will initiate further actions for maintenance checks and inspections. If the pilots are doubtful about the landing, they can request a print of Load <15>. The Load <15> report is generated automatically or manually by request of the pilots.

In our case there was no automatically print out of Load <15> report due to missing paper in the DMU printer.

3. Conclusions

3.1 Findings

From the evidence available the following findings are made about the Severe Hard Landing involving the Airbus A320-232 with the registration marks SX-ORG that occurred at Pristina International Airport on 1st of December 2017. It is reminded once again that these findings should not be read as assigning blame or liability to any particular organization or individual.

3.2 Contributing Factors

- The maneuvers of the PF on the stick seconds before touchdown. There were several nose up and nose down inputs at very low height.
- A late full back stick applied by the PF at 20ft/RA. This action was too late to change the vertical descent rate, so the hard landing was unavoidable at this point.
- The weather circumstances during that night were contributing factors to this occurrence, it was snowing and the runway was wet.
- Decision of the flight crew to have a Positive Landing resulted in an increased rate of descent
- Touchdown occurred with a high rate of descent (880 ft/min) as a result the Severe Hard Landing occurred.
- The left side window of the PF was foggy and was out of order because the heating was not working and the captain had reduced peripheral view. This malfunction was an MEL item, was inoperative and was out of order, the flight crew were in aware of it.

3.3 Findings as to Risk

- The flight crew failed to obtain the task written in the AMM 05-51-11-200-004 regarding that the flight crew are responsible to make a report if they think that there was a hard/overweight landing.
- Missing printer paper in the DMU was an MEL item, but also crucial for printing the Load <15> report and confirming the landing parameters.
- The aircraft continued to fly 8 more sectors without any inspection which might lead to compromising the safety of flight operations.

4. Safety Recommendation

Note: In accordance with Law No. 03/L on Civil Aviation of Republic of Kosovo and the article 17.3 of Regulation AAIIC/OPM No.01/2017 on the investigation and prevention of accidents and incidents in civil aviation, a safety recommendation shall no in no case create a presumption of blame or liability for an accident, a serious incident or an incident. The addressee of a safety recommendation shall inform the safety investigation authority which issued the recommendation of the actions taken under consideration under the conditions described in the Article 18 of the aforementioned Regulation.

4.1 Safety actions

4.1.1 Reporting of High Load

The investigation showed that the missing paper in the DMU that had to print out the Load <15> report automatically, was an MEL item category D. The repair interval of this item was 120 consecutive days. The operator does not have install ACARS system on their headquarters facilities and the main source for reporting the high load/hard landing was the flight crew. The reporting of this hard landing did not occur right after the landing and the aircraft continued to fly.

4.1.2 ACARS

Aircraft Communication Addressing and Reporting System (ACARS) is a digital link system for the transmission of messages between aircraft and ground. ACARS equipment onboard of the aircraft is called Management Unit (MU). This functions as a router for all data transmitted or received externally. A Datalink Service Provider (DSP) is responsible for the movement of messages via radio link.

Consequently AAIIC recommends that:

Safety Recommendation AAIIC 2018-01

The Operator Orange2fly to implement an ACARS system or to ensure that there will be no paper shortage in the DMU.

4.1.3 Training of the flight crew

According to operators Approved Maintenance Manual 05-51-11-200-004 the flight crew is responsible to make a report if they think there was a hard/overweight landing. According to factual information the flight crew decided to continue to fly 8 more sectors with high risk without reporting the hard/overweight landing.

Consequently AAIIC recommends that:

Safety Recommendation AAIIC 2018-02

The operator Orange2fly to ensure a safety training to the flight crew regarding reporting a hard/overweight landing.

Investigator in charge:

- Arben Dika – Aeronautical Accident and Incident Investigation Commission (AAIIC) of Republic of Kosovo.

Source of information

The sources of information during the investigation included the:

- Air Traffic Control of Republic of Kosovo
- Civil Aviation Authority of Republic of Kosovo
- Pristina International Airport – Adem Jashari
- Airbus
- Orange2fly
- Airbus – Safety First nr.26, article on High Load Event Reporting