

FINAL REPORT

of

Investigation of a serious incident, occurred on July 18, 2017 at Burgas Airport, Bulgaria, by AIRBUS A320-232, registration marks SX-ORG, operated by ORANGE2FLY



Purpose of the report and level of responsibility

In accordance with Annex 13 to the Convention on International Civil Aviation of 7 December 1944, Regulation 996/2010 of the European Parliament and the Council on the investigation and prevention of accidents and incidents in civil aviation and Ordinance 13 of 27.01.1999 of the Ministry of Transport, Information Technology and Communications, the objective of the aviation occurrence investigation is to establish the causes that have led to its realisation in order these to be eliminated and not allowed in the future **without apportioning blame or liability**.

CONTENTS

1.	Introduction	6
2.	Factual information	6
2.1.	Flight history	6
2.1.1.	Flight number, type of operation, last point of departure, time of departure, destination point of intended landing:	6
2.1.2.	Flight preparation and description of the flight	7
2.1.3.	Location of aviation occurrence	8
2.2.	Injuries to persons	8
2.3.	Damage to Aircraft	8
2.4.	Other damages	8
2.5.	Personnel information	8
2.5.1.	Commander	8
2.5.2.	First officer	9
2.5.3.	Cabin crew	9
2.6.	Information about the aircraft	9
2.6.1.	Airworthiness information	9
2.6.2.	Short information on aircraft technical characteristics	9
2.6.3.	Aircraft Weight and Balance	9
2.6.4.	Hydraulic system operation	10
2.6.5.	Information about fuel used	10
2.7.	Meteorological information	11
2.7.1.	Weather at the time and location of the occurrence	11
2.7.2.	Meteorological conditions at Burgas airport:	11
2.7.3.	ATIS information for Burgas Airport:	11
2.8.	Navigation	11
2.9.	Communications	11
2.10.	Information about the airport	11
2.11.	Flight recorders	12
2.12.	Wreckage and Impact Information	13
2.13.	Medical and Pathological Information	13
2.14.	Fire	13
2.15.	Survival Factors	13
2.16.	Testing and research	13
2.17.	Information about organizations and administrative activities	14
2.18.	Additional information	14
3.	Analysis	15
4.	Conclusion	18
4.1.	Findings	18
4.2.	Causes:	19
5.	Safety Recommendations:	19
	APPENDIX 1	20
	APPENDIX 2	25

01 List of Abbreviations

A/C	- Aircraft;
A/THR	- Autothrust;
AAIU	- Aircraft Accident Investigation Unit;
AGL	- Above Ground Level;
ALT	- Altitude;
AMRTAIU	- Air, Maritime and Railway Accident Investigation Unit;
AO	- Airline operator;
AOC	- Air operator certificate;
AP	- Autopilot;
APP	- Approach control unit or approach control service;
ATIS	- Automatic Terminal Information Service;
ATPL	- Airline Transport Pilot Licence;
CAA	- Civil Aviation Law Act;
CAS	- Computerised Air Speed;
CM1	- Crew Commander;
CM2	- Co-Pilot;
CRM	- Crew Resource Management;
CVR	- Cockpit voice recorder;
DFDR	- Digital Flight Data Recording;
EASA	- European Aviation Safety Agency;
ECAM	- Electronic Centralized Aircraft Monitor;
FCOM	- Flight Crew Operating Manual;
FCTM	- Flight Crew Training Manual;
FD	- Flight Director;
FDR	- Flight Data Recorder;
FL	- Flight Level;
FMA	- Flight Mode Annunciator;
FPA	- Flight Path Angle;
ft.	- Feet;
GAT	- General Air Traffic;
GSPD	- Ground speed;
GW	- Gross Weight;
ICAO	- International Civil Aviation Organization;
IFR	- Instrument Flight Rules;
kg	- Kilogram;
km	- Kilometre;
kts	- Knots;
LBBG	- Burgas Airport;
LD	- Landing distance;
LDA	- Landing Distance Available;
LKTB	- Brno Airport;
M	- Mach's number;
MHz	- Megahertz;
MEL	- Minimum Equipment List;
MSN	- Manufacturer Serial Number;
MTITC	- Ministry of Transport, Information Technology and Communications;
MTOW	- Maximum Take Off Weight;
NM	- Nautical Mile;
NOTAM	- Notice to Airmen;
NOSIG	- No significant change;

PFD	- Primary Flight Display;
PFR	- Post Flight Report;
PIC	- Pilot in Command;
QNH	- Atmospheric pressure adjusted to mean sea level;
QRH	- Quick Reference Handbook;
RESA	- Runway End Safety Area;
RNAV	- Area Navigation;
RWY	- Runway;
SCT	- Scattered;
SOP	- Standard Operating Procedures;
TCU	- Towering cumulus;
TDZ	- Touchdown zone;
TLB	- Technical Log Book;
TRI(A)	- Type Rating Instructor (Airplane);
UTC	- Universal Coordinated Time;
VRB	- Variable;
VIS	- Visibility;

1. Introduction

Date and time of this aviation event: July 18, 2017, 08:48 h local time (05:48 UTC).

The difference between universal coordinated time and local time is +3 h. All times in this report are in UTC.

Notified: Aircraft, Maritime and Railway Accident Investigation Unit Directorate (AMRAUD) and Directorate General "Civil Aviation Administration" (DG CAA) of the Republic of Bulgaria, European Commission (EC), International Civil Aviation Organization (ICAO), Air Safety Investigation and Analysis Bureau (BEA) of the Republic of France, Hellenic Republic's Air Accident Investigation and Aviation Safety Bureau, Air Accidents Investigation Institute (AAII) at Czech republic, European Aviation Safety Agency (EASA).

On the grounds of article 9, paragraph 1 of Ordinance №13, dated January 27, 1999 on the investigation of aircraft accidents, this event has been classified by AAIU from Directorate AMRAUD of MTITC as a serious incident. The materials about the aircraft incident have been registered as "Case № 04 18.07. 2017" in the archives of AAIU. Pursuant to article 5, paragraph 1, of Regulation (EC) No 996/October 20, 2010 about investigation and prevention from accidents and incidents in civil aviation, article 2 of CAA from December 01, 1972, article 10, paragraph 1 of Ordinance No 13 of the Ministry of Transport from January 27,1999 for investigating of aviation accidents, with Order № RD-08-304 from August 02, 2017 of the Minister of Transport, Information Technology and Communications a Commission to investigate the serious incident is appointed.

Summary: On July 18, 2017, an Airbus A320-232 with registration marks SX-ORG of Greek airline operator "ORANGE2FLY" performed a regular charter flight under call sign TVS1482 on behalf of AO "Smart Wings" from Brno to Burgas (LKTB – LBBG). At an altitude of 1292 ft on final approach for RWY 04, a Green Hydraulic Low Level fault due to fluid leakage led to a Green hydraulic pressure failure, which the aircraft suffered at an altitude of 740 ft. After touchdown, the aircraft departed control flight, at about the middle of the runway length uncontrollably veered to the right, leaving the asphalt surface and stopped in the soft ground in front of the apron. All 179 passengers and 6 crewmembers without injuries left the aircraft normally by mobile stairs. Airplane received some minor damages on the landing gear and the left engine. The emergency plan of Burgas Airport has been activated and it remains closed for 3 hours and 27 minutes. During this time, the arriving traffic was diverted to alternates in Bulgaria and to neighbour countries.

As a result of the investigation, the Commission considers that the serious incident is due to following **reasons:**

1. Green hydraulic system failure due to hydraulic leak during approach for landing and as a result other failures affecting the aircraft control and performance during rollout after landing.
2. Pilot's actions in landing phase after touchdown, resulting in inability to maintain the runway centre line direction under conditions of complete failure of Green hydraulic system and subsequent failures, as applying and keeping full reverse power with only right engine reverser operational, while having a reduced braking effect of the left brakes and Nose Wheel Steering inoperative.
3. CRM, during a high workload flight phase with multiple technical failures and warning inhibition to the crew by aircraft design, led to a wrong decision to continue approach for landing and therefore did not perform an assessment of possible systems effects and no corrective actions were taken timely.

2. Factual information

2.1. Flight history

2.1.1. Flight number, type of operation, last point of departure, time of departure, destination point of intended landing:

Flight number:	TVS1482.
Type of operation:	International passenger charter flight.
Last point of departure:	Brno Airport (LKTB), Czech Republic.

Take-off time: 04:19 h UTC.
Destination point: Burgas Airport (LBBG), Bulgaria.

2.1.2. Flight preparation and description of the flight

The 180-seat A320-232 aircraft with registration marks SX-ORG, hired on a „wet“ lease by Greek operator „ORANGE2FLY“, is planned for QS 1482 flight of Czech AO „Smart Wings“. The standard crew consists of commander, first officer and four flight attendants. The airplane is dispatched at Brno airport with one deactivated brake on the left main landing gear according to MEL 32-42-01A. The performed maintenance activities are recorded in TLB and the maintenance and operational limitations and procedures are detailed in MEL. The other brake device on the same landing gear is also used, but has not been changed since it is within acceptable clearance (Figure 9 of Appendix 1). The both two right hand brake devices are visibly new, as seen on brake wear pin length (Figure 10 of Appendix 1). With his signature in the log, the commander confirms that crew is familiar with the technical condition of the aircraft and accepts it for the flight, according to SOP of ORANGE2FLY. By Captain's decision, crew functions are defined as follows - a pilot-in-command is the commander (CM1), pilot monitoring - the first officer (CM2).

The chocks off time is 04:14 h. The engines start-up and taxiing to line-up are executed without any particularities. Aircraft takes off from RWY 27 at Brno airport at 04:19 h. Climb out, cruise flight at FL 370 and initial descent are also normal. „RNAV APP for RWY 04“ at Burgas airport, announced by ATC and confirmed by the crew, is performed without deviations. Landing gear, flaps and slats are selected to full down position according to the limitations in SOP. The „Landing Check List“ has also been read and executed on time. Crew actions are in line with the aircraft's limitations, normal operating procedures and stabilized approach criteria. No failures are registered during the descent until altitude of 1300 ft AGL.

At 05:46:36 h, at 1292 ft altitude, HYD system page comes on ECAM lower display (SD) and caution message "HYD GREEN RESERVOIR LOW LEVEL" appears on ECAM upper display, listing specific crew actions (ECAM actions). This message remains active for 12 seconds and disappears at 1152 ft altitude. According to crew, after LOW LEVEL disappeared, following a CM1 command "Check systems' status", reads out the STATUS page, which shows "NORMAL". This is confirmed by aircraft recordings at 05:47:16 h (STATUS PAGE appears), as GREEN HYD system had still normal pressure at this time and there were no faulty systems yet due to GREEN HYD system pressure. The pilots decided to continue down on prescribed route with autopilot engaged ON, because the ECAM warnings disappeared and they decided that there was no more need to read and do a relevant checklist.

At 05:47:53 h, at 400 ft altitude and speed of 139 kts, CM1 switches off autopilot AP1. Touchdown on the runway is normal, performed at 05:48:32 h in the normal landing area, 300 meters (1000 ft) from the threshold. The RWY is wet from a recent rain, but the braking action is good. CM2 reports partial (incomplete) activation of the spoilers. The pilot in command selected both reversers ON, but only the right one is activated. It appears a tendency for veering to the right, as in the beginning the RWY centre line direction is successfully maintained with the rudder only. Subsequently CM1, even importing maximal deviations of the rudder, separate (unsymmetrical) use of the brakes and attempting to operate the nose landing gear, fails to keep aircraft within RWY.

At 05:48:52 h and 61 kts the plane leaves RWY uncontrollably at a distance of 1750 meters from its beginning. The brakes and the right engine reverser remain activated at their maximal positions and the aircraft enters the soft ground, facing to the apron. At 05:49:05 h, GSPD = 27 kts, on course 095°, CM1 turns off the reverser and retracts the spoilers. CM2 reports to ATC: "TVS1482 leaving the runway." Aircraft passed 120 m out of the runway on the wet lawn, stopping at 5:49:12 h, about 30 m aside its centre, on course 152°, at a distance of 2006 m from the beginning of the runway. Excursing the runway, the aircraft passes over a few RWY lights, past over a drainage cover and hit a signboard on the ground.

After full stop of the aircraft, the commander orders the passengers and the cabin crew to keep their seats in readiness for emergency evacuation and stops the engines. Subsequently, this command is

cancelled and coordinated with ATC and airport emergency services, all people on board are normally disembarked by mobile ladders and transported to the terminal.

2.1.3. Location of aviation occurrence

Location Burgas Airport, (LBBG), Bulgaria.
Date and Time July18, 2017, 05:48 h UTC, daylight.
Coordinates of stopped A/C: N 42°34'18" E 027°3'13".

2.2. Injuries to persons

No injuries of crews, passengers or other persons in result of the air occurrence.

Injuries	Crew members	Passenger	Total number of occupants	Others
Fatal	0	0	0	0
Serious	0	0	0	0
Minor	0	0	0	0
None	6	179	185	0
Total	6	179	185	0

2.3. Damage to Aircraft

The following damages were found during the aircraft inspection of its final stop:

- A slot of 800 mm in length and 20 mm in outboard Fan Cowl of engine No1 (Figure 4 of Appendix 1) caused by a collision with taxiway indicative sign when the aircraft exit the RWY (Figure 3 of Appendix 1);
- R/H MLG Downlock actuator flexible hoses external leak (Figure 6 of Appendix 1);
- Traces of leaked hydraulic fluid from Green hydraulics in the right main landing gear bay (Figure 6 of Appendix 1);
- Cut tyre protector from wheel № 4 of the main landing gear while passing through a side-marker lamp from RWY lights system (Figure 7 of Appendix 1);
- Contamination with grass and mud on the landing gear, wings and tail due to the movement of the aircraft on the ground outside the runway, Fig. 8 of Appendix 1.

2.4. Other damages

After leaving RWY, the aircraft has caused damages to airport infrastructure elements as follows:

- Broken lamp of RWY edge lights system, fig. 2 of Appendix 1;
- A cover of the RWY drainage system is damaged, fig. 2 of Appendix 1;
- An aerodrome indicative sign is damaged, Fig. 2 of Appendix 1.

2.5. Personnel information

2.5.1. Commander

Male, 50 years old, pilot of ORANGE2FLY

License: ATPL (A), valid through March 31, 2018;

Qualification remarks: A320 PIC, IR, TRI (A);

Medical certificate: Class 1, valid through August 21, 2018;

Last Recurrent Check: March 14, 2017;

Last OPC check: March 15, 2017;

Last line check: June 16, 2017;

Total Flight Hours - 13208 h, of which:

- as a Commander - 5241:00 h;
- as a Commander of A320 - 2850:00 h.
- for the last year - 375:46 h;
- for the last 28 days - 38:51 h;
- for the last 24 hours - 01:39 h;

Rest before flight - 18:20 h.

2.5.2. First officer

Male, 33 years old, pilot of ORANGE2FLY

License: ATPL (A), valid through 30.04. 2018;
Qualification remarks: A320, FO;
Medical certificate: Class 1, valid through January 22, 2018;
Last Recurrent Check: April 23, 2017;
Last OPC check: April 24, 2017;
Last line check: August 31, 2016;

Total Flight Hours - 735: 18 h of which:

- on the type A320 - 521: 00 h;
- for the last year - 309: 53 h;
- for the last 28 days - 30:37 h;
- for the last 24 hours - 01:39 h;

Rest before flight - 18:20 h.

2.5.3. Cabin crew

Standard for the aircraft type, 4 members. According to the contract between AO, the senior flight attendant is from ORANGE2FLY, the other three are Smart Wings (Travel Service) staff.

2.6. Information about the aircraft

2.6.1. Airworthiness information

The aircraft holds valid:

- Registration Certificate - issued by HELLENIC CAA on July 13, 2016;
- Airworthiness Certificate - № 1603, issued by HELLENIC CAA on June 28, 2016;
- Airworthiness Review Certificate - № 021, issued by HELLENIC CAA on June 28, 2016, valid through June 27, 2017; extended on June 10, 2017 with validity through February 12, 2018

The airplane is dispatched for flight with non-operating and deactivated braking device №1 on the left main landing gear according to MEL 32-42-01A and 32-42-05A after a notice, recorded from the previous flight in TLB: "Main Wheel Brake №1 worn to limit". The maintenance staff at Brno airport deactivates the brake unit on wheel №1 and the automatic braking system. This results in additional conditions and operating procedures that the crew has to comply before and during the flight.

These dispatching activities under MEL are correctly recorded in TLB № 1383 before crew to start pre-flight preparation.

On July 18, 2017, the aircraft in such condition was accepted by the crew, which is certified by commander's signature in TLB №1383.

2.6.2. Short information on aircraft technical characteristics

A320-232, registration marks SX-ORG, is a 180-seat, twin-engine passenger aircraft, designed for short and medium range operation. It was produced on February 20 2001 by European AIRBUS aviation consortium in the factory near Toulouse. In the next years it has been operated by various operators and since June 2016 Greek AO ORANGE2FLY has leased it.

Type: Airbus A320;
Manufacturer serial number: 1407;
Engines: IAE V2500;
Registration: SX-ORG;
Total hours/cycles: 35407:38 / 17798:00;
Owner: WILMINGTON TRUST SP SERVICE Ltd, Ireland.

2.6.3. Aircraft Weight and Balance

For this flight, according to the Load Sheet, the actual take-off weight is 66026 kg while the maximal allowed one is 77000 kg; and the actual landing mass is 62015 kg while the maximal

allowed one is 64500 kg. The Commission accepts that the aircraft has not been overloaded and that the distribution of passengers and baggage has been in an operating range.

2.6.4. Hydraulic system operation

The A320 has three main hydraulic systems, which supply the high power consumers of the aircraft with hydraulic power. The three main systems are hydraulically isolated from each other. The three different systems - Green, Yellow and Blue are involved in the airplane controls on the ground and in the air. Partial or complete failure of one or more of them leads to inoperable airframe or engine systems.

All three hydraulic systems have to operate together in flight, ensuring redundancy of systems. Normal gear up and gear down is carried out by the "Green" hydraulic system and eventual failure results in total loss of the following systems and controls:

- Green hydraulics system (GREEN HYD);
- Spoilers 1+5 (SPLR 1+5);
- Normal braking system;
- Auto braking system;
- ENG 1 Thrust Reverser;
- Nose Wheel Steering.

Relevant components of the primary and secondary flight controls have lost their full capacities but airplane control in the air retains its full operational capability. However, it is necessary to use alternative methods to maintain RWY direction after touchdown - use of rudder until its efficiency threshold (61 kts), separate use of brakes and single operation of the remaining thrust reverser.

The manufacturer has developed a system ECAM on aircraft for monitoring and displaying engine and aircraft system information to the pilots. In the event of a malfunction, it will display the fault and may display the appropriate steps of the remedial action. According to them, flight failures are warning by relevant messages (ECAM MESSAGES) on a display located on the instrument panel in front of both pilots. When appeared, certain crew actions are required as presented on the display, with subsequent reference to procedures in QRH, FCOM and/or OEB. In many cases it is imperative to recalculate the flight characteristics (speed and weight), the required runway length and width, take-off or landing distances. It is necessary to take account of the affected by this failure systems and controls that are not working or partially operating. An inquiry on STATUS ECAM page follows about the current state of all systems and after that, a decision how to continue the flight can be taken. All these actions require to be carried out in a calm stage of flight or in a holding pattern, after actions provided in the control cards have been completed. However, many of these messages at certain phases of the flight remain "hidden" for the crew i.e. they are not displayed on the screen below a certain height or speed. They are reactivated later when reaching a certain height or speed.

Such is the case with a complete failure of Green hydraulics system due to dropped liquid level in the hydraulic reservoir below the minimum. Airplane manufacturer AIRBUS SAS has described such a procedure published in FCOM and FCTM of the operator - "A320 Abnormal and Emergency Procedures HYD G RSVR LO LVL" (see Attachment 2 - Documents).

2.6.5. Information about fuel used

At 05:50 LT the aircraft was refuelled at Brno with 5783 litres of fuel - kerosene type JET A-1 reaching the requested total quantity of 8300 kg. According to the computerized flight plan, the estimated fuel consumption to Burgas is 4500 kg plus 200 kg for engine start up and taxiing to line up. At the time of touchdown at Burgas Airport, there were 4089 kg on board or 4011 kg actually used.

The fuel quantity and its condition are not considered to be relevant to the occurrence.

2.7. Meteorological information

2.7.1. Weather at the time and location of the occurrence

In the morning hours of July 18, 2017, Bulgaria is located in the south-eastern periphery of an anticyclone. Above the extreme southeaster parts of the country at high altitude, there is a filling cyclonic whirlwind that determines the development of cumulus-rain clouds over the region, with the convective clouds being gradually exported in the southeast direction.

2.7.2. Meteorological conditions at Burgas airport:

Clouds: SCT TCU 3000 ft;
Visibility: 9 km;
Wind: 310 °/7kts, varying between 290 ° and 010 °;
Temperature / Dew Point: 18 °C / 16 °C;
Atmospheric Pressure: QNH 1018 hPa.

2.7.3. ATIS information for Burgas Airport:

- This is Burgas information "J";
- ATIS Report at 0530Z;
- RNAV approach;
- Runway in use 04;
- Runway is wet;
- Flock of birds in the vicinity of RWY, ALT unknown;
- Transition Level 130;
- WIND: TDZ - 310 / 7KT, VRB BTN 290 AND 010;
- VIS: 9 km;
- FBL SHRA, SCT TCU 3000FT, BKN4900FT;
- Temperature 18 °;
- Dew point 16 °;
- QNH 1018 hPa;
- TREND NOSIG.

Braking action was not published, seems to be good. The meteorological conditions at the time of the air occurrence realization were of no effect to the serious incident.

2.8. Navigation

The aircraft SX-ORG performed the flight with the standard navigation equipment of the aircraft A320-232. There were no reported any technical failures of the navigation equipment. The approach to RWY 04 at Burgas airport is carried out under the RNAV procedure, published in „Aeronautical Information and Publication“ (AIP) of the Republic of Bulgaria and in all navigation charts.

In the 24 hours report of the Air Traffic Control Centre - Burgas, there are no failures of technical devices that directly affect the operational activity at the moment of the event.

2.9. Communications

The air-ground radio communication between the flight crew and ATCO-Tower at LBBG was carried out at the frequency of 118,000 MHz.

Bilateral radio communication between the flight crew and ATCO-APPROACH at LBBG was carried out at the frequency of 125,100 MHz.

The Bulgarian Air Traffic Services Authority provided a transcript of the radio-communication of Burgas-Tower, Burgas-APP at frequencies 118,000 MHz and 125,100 MHz. After hearing the radio conversations at the work frequencies of Burgas-Tower and Burgas-APP, the Investigation Commission found that there had been no loss of radio communication and there had been no interruptions and disturbances of the radio broadcasting.

The records are attached to the investigation materials.

2.10. Information about the airport

Aerodrome Location Indicator and Name – BURGAS AIRPORT (LBBG);

Aerodrome coordinates and site at aerodrome – N 42°34'13" E 027°30'55", RWY centre;
Elevation - 135 ft. (44 m);
Designations / RWY 04/22 - MAG 040°/220°;
Dimensions of RWY (m) - 3200 x 45 m;
The approach from/to the apron happens by 5 taxiways: A, B, C, D and E.

2.11. Flight recorders

After the event, the record from QAR memory card was downloaded for decoding by experts from AAIU immediately after aircraft was moved to the apron of Burgas Airport. Between this analysis and the AEROBITES analysis provided by the operator, there are minor differences in times (a few seconds of difference), but they do not have any influence on the explanation of the reasons leading to the serious incident. Cockpit voice recorder (CVR) is not downloaded for analysis. Below is a brief summary of the analysed flight data.

SX-ORG takes off from Brno at 04:19 h (UTC). Flight to Burgas was piloted by the commander and was executed at FL 370. There were no deviations in systems operation and piloting during take-off, climbing and en-route.

At 05:19 h the flight crew begins descent from FL 370, facing to Burgas airport in heading 126° with AP1 switched ON.

During the descent three times for 70 ÷ 80 s, spoilers' SPEEDBRAKE function was used. Respectively at heights 17000, 7800 and 5100 ft AMSL, spoilers "3" and "4" diverged to -25 °, and spoiler "2" was diverted to -12.5 °. These values correspond to the maximum possible when the autopilot is switched on.

At 05:42:34 h at ALT=3076 ft, heading 132° and CAS=217 kts, the flaps are set to position 1 and the slats are extended from 0° to 18°.

At 05:45:02 h at ALT=2572 ft, heading 040° and CAS=186 kts, the flaps are set to position 2 and the slats are extended from 18° to 22° and flaps from 0° to 15°.

At 05:45:26 h at ALT=2216 ft, a "Ground Spoiler Armed" command is registered.

At 05:45:34 h at ALT=2092 ft, heading 038° and CAS=179 kts, landing gear is extended, the flaps are set in position 3 and the flaps are moved from 15° to 20°.

At 05:45:53 h at ALT=1980 ft, course 038° and CAS=163 kts, the flaps are set to "FULL" and the slats are extended from 22° to 27°, and the flaps are moved from 20° to 40°.

At 05:46:36 h at ALT=1292 ft, for 16s is registered "Hydraulic page" on ECAM possible due to low level at Green Hydraulic system and due to activation of Master Caution.

At 05:47:24 h at ALT=740 ft and CAS=141kts for 40s is registered again "Hydraulic page" followed by "Hydraulic Low Pressure-Green". At the same time, "Auto Brake Fault" and "Normal Brake Fault" appear.

At 05:47:53 h at ALT=400 ft and CAS=139 kts autopilot AP1 is switched off.

At 05:48:04 and height 347 ft RA, SD STATUS page is displayed for 4 secs, then HYD page is displayed for 4 secs, then the STATUS page is displayed again at 05:48:16 for 4 secs at a height of 216 ft RA. These SD page changes are registered at a low height just before touchdown, while a number of consequential failures existed due to GREEN HYD system LO PRESS at this time.

Touchdown on RW 04 is at 05:48:32 h with CAS=132 kts and vertical overload $N_y=1.30g$. The gross weight at the moment of touchdown is 62015 kg and GSPD is 140 kts.

At the moment of touchdown, the spoilers divert respectively: spoilers "2", "3" and "4" up to 40°, and spoilers "5" to 12.5°. Left and right spoiler commands "1" are also registered. Both engine handles are set to "FULL REVERSE", deploying only the right engine reverser. At the same time with the reverser and spoilers open, the left and right brakes are pressed initially in a varying asymmetrical braking sequence. "NORMAL BRAKE PRESSURE" on wheels 1÷4 shows 0 psi on FDR data. This is expected due to Normal Braking supply from GREEN hydraulic, which was lost. However, Alternate Braking from yellow Hydraulic, with antiskid, should provide alternate braking pressure by aircraft configuration. Alternate Braking pressure is a parameter not selected to be recorded in FDR, so there are not any recorded data regarding the Alternate Brake Pressure. A

discrete signal for ALTERNATE BRAKING is recorded "OFF" all the time, creating ambiguity on the operation of Alternate Braking with antiskid.

As a result, a brake acceleration of 0.23g is obtained and the aircraft decreases its speed from GSPD=140 kts to 61 kts in 20 seconds.

At 05:48:52 h, GSPD=61 kts, an increase of the airplane heading (deviation to the right) begins. In the next second, right brake is released to 0° while the left brake is fully pressed, right spoiler "1" is retracted and right spoiler "5" is gradually lowered from 12.5°. The heading continues to increase and at 046°, GSPD=54 kts, the right brake is pressed again to the maximum.

At 05:48:53 h an increase in the vertical overload is registered (airplane exited the RWY) and a significant increase of heading and a reduction in speed. The maximum value of $N_y = 1.39g$.

At 05:49:05 h, GSPD=27 kts and heading 095° the reverser is set OFF and the spoilers are retracted.

At 5:49:10 h, GSPD=5 kts, „Hydraulic Low Pressure-Green”, as well as „Auto Brake Fault” and „Normal Brake Fault” signals disappear. There is a pressure in the brakes on wheels 1÷4, which reaches 1400 psi with maximum brakes applied.

At 05:49:12 h the aircraft stops its movement at a heading of 152°.

At 05:49:18 h, while the brakes are still pressed, "Hydraulic Low Pressure-Green" and "Normal Brake Fault" alarms appear again and continue for 20 seconds.

At 05:49:27 h the brakes are released.

At 05:49:37 h the brakes are pressed again, twice for 1 second, and no brake pressure is registered.

At 05:57:23 h, stops DFDR record.

For the analysis of the occurrence were also used data from the recording devices of ATS Burgas Airport Centre about radar picture and radio communication, as well as telephone recordings of ATCO with the other sectors. The records are attached to the investigation materials in AAIU folder "Case No 04 / July 18, 2017".

2.12. Wreckage and Impact Information

The occurrence does not lead to airplane destruction. There are no aircraft and airport infrastructure debris from the impact with an aerodrome indicative sign and a catch-water canal surface. Airplane damages are described in paragraph 2.3 of the report.

2.13. Medical and Pathological Information

There were no injured people in the serious incident and therefore no medical and pathological researches are carried out.

2.14. Fire

No fire occurred during the event.

2.15. Survival Factors

There are no structural destructions or threat of fire in the movement of aircraft on and outside RWY until its final stop, so no emergency rescue equipment is used.

2.16. Testing and research

For the purposes of the investigation, the Commission conducted and carried out a number of activities, quoted below. External experts with experience in the operation and maintenance of A320 aircraft were also attracted. All the investigation papers have been archived in "Case No. 04 / July 18, 2017" of Bulgarian AAIU.

1. Inspection of Airbus320-232 aircraft, registration marks SX-ORG;
2. Inspection of the aerodrome area where aircraft has passed from touchdown until its final stop;
3. Analysis of the meteorological situation in the region of Burgas and on the route;
4. Interview with the flight crew and airport officials, eyewitnesses of the event;

5. Interview with ATCO „Tower“ and ATCO „Approach“ at Burgas Airport, which carry out air traffic control during the serious incident;
6. Collecting, documenting, listening and analysing radar picture recordings and radio communication between flight crew and ATCO „Tower“, ATCO-APP at Burgas Airport;
7. Analysis of the flight crew and ATCO actions during the aviation event;
8. Discussed and analysed data from the flight crew report;
9. Analysed flight data from FDR of Airbus 320-232 aircraft, registration marks SX-ORG;
10. Studying and analysis of aircraft operating documentation;
11. Assessment of aircraft flight performance characteristics;
12. Assessment of Green hydraulics defective components condition that have caused leakage of hydraulic liquid into the atmosphere;
13. Flight parameters analysis, engine status, systems and flight controls of the airplane according to FDR and PFR data;
14. Simulating flight on a Flight Simulator with another crew having the same conditions, failures and flight parameters;
15. Logics & probabilities analysis for possible causes of the aviation occurrence.

Photos from the airplane overview and the aerodrome are shown in Appendix 1. The results of activities, appointed in paragraphs 1 and 2, are shown in paragraphs 2.3 and 2.12 of this report.

The results of activities, appointed in paragraph 3 are shown in paragraph 2.7 and for those appointed in 4, 5 and 6 are shown in paragraphs 2.1.2 and 2.12.

The results of exploring and analysis of airplane operational documentation are given in paragraph 2.6.1.

Flight and technical performance of the airplane, relevant to the event, are assessed in paragraph 2.6.

The FDR analysis of aircraft A320-232, registration marks SX-ORG, are given in paragraph 2.11.

A logical-probabilistic analysis of possible causes for the aviation event is made in paragraph 3 of the report.

2.17. Information about organizations and administrative activities

Since the date of its production, A320-232 aircraft with registration marks SX-ORG has been leased to 10 different operators. Since June 2016, it has been in the register of Greek AO “ORANGE2FLY”, from where it was chartered in May 2017 on a „wet“ lease by Smart Wings - budget operator, part of Czech's largest AO “Travel Service” for their busy summer season. The type of operation is only passengers and cargo flights from Prague, Brno and Bratislava airports to charter destinations mainly in Greece, Spain, Italy, Bulgaria and Cyprus. This commercial activity is authorized by the relevant aviation authorities. Both organizations hold the required AOCs valid on the date of the serious incident.

2.18. Additional information

The Safety Investigation Commission has requested an opinion from the technical organization Lufthansa Technik Sofia Ltd, which has carried out A/C repair at Burgas Airport. From the information obtained, it is clear that a mechanical damage of the hydraulic hose feeding the locking hydraulic cylinder of right main landing gear causes the liquid to be thrown out into the atmosphere. This has resulted in a total loss of the Green hydraulics at landing approach and subsequent airplane control problems when roll out down the RWY. The Commission has requested information for eventual replacements or repairs of the problematic components. Analysis of the technical documentation provided by the operator, shows that the defective components have not been replaced since the start of exploitation, as this should be carried out in accordance with the maintenance programme. On every major inspection, they are classified as operational if there are no leaks or mechanical damages.

Airbus removed NWS from GREEN HYD system supply in newer aircraft configurations, using Yellow instead.

3. Analysis

The Safety Investigation Commission considered the following main hypotheses for possible causes that led to the serious incident:

First hypothesis: Unfavourable weather phenomenon that might lead to a sudden change of aircraft trajectory during the landing approach, subsequently leaving the RWY;

Second hypothesis: A failure in the aircraft's control system, brakes, or other technical failure affecting aircraft behaviour, especially its controllability during the landing roll;

Third hypothesis: Errors in piloting during the flight.

With regard to the first hypothesis, the Commission did not find any information about the presence of an adverse weather phenomenon, which could lead to a sudden change in the aircraft trajectory during the landing. In the analysis of the weather situation in South-Eastern Bulgaria, the region of Burgas and the airport, the Commission did not find evidences for presence of dangerous phenomena in TAF and METAR broadcasts. Considering what was outlined in paragraphs 2.9.1, 2.9.2 and 2.9.3 of this report, discussions with the pilots of this and other aircraft, landed or took off at approximately the same time, ATC and airport officials, witnesses of the event, the Commission rejected the possibility that the event was a result of an adverse meteorological phenomena that led to a sudden variation of aircraft trajectory during the landing, and leaving RWY.

With regard to the second hypothesis - technical failure:

The Commission analysed:

- The analysis of Digital Flight Data Recorder (DFDR) in text format;
- Aircraft technical documents, presented by AO, and the corrective maintenance actions, performed by Lufthansa Technik - Sofia;
- A copy of Post Flight Report (PFR) for warning messages and failures in flight;
- Written explanations of the crew.

The technical failures could result in RWY excursion in landing roll phase. Such are failures of components of flight control systems on the ground, which could happen also during the flight. During the post flight inspection, a leakage of hydraulic fluid was found in the area of the right-hand main landing gear bay, caused by a broken hose of the Green hydraulics, feeding a locking cylinder for the right-hand main landing gear, Fig.5 and Fig.6 of Appendix 1. This directed the Commission to a depth analysis about Green hydraulic system failure causal relationship for direct influence to aircraft control during the landing phase.

The Commission accepted that the aircraft was correctly dispatched with one inoperative and deactivated braking device on the left-hand main landing gear (LH MLG) according to A320 MEL Section 01-32 / System 32-42 Normal Braking / Item 42-01 Main Wheel Brake. The pilots were familiarized in advance, as it was confirmed by captain's signature in TLB, certifying that A/C was taken into account the relevant MEL limitations. This way the aircraft was accepted by crew as airworthy and ready for flight. The restrictions (technical and operational) for admission to a flight in this condition require the following circumstances to be expressly provided:

- 1) The anti-skid system is operative, and;
- 2) Nose Wheel Steering is operative, and**
- 3) Affected brake is deactivated or removed, and
- 4) Both reversers are operative, and**
- 5) Green and Yellow systems are operative on operative brakes, and**
- 6) Tachometers associated with operative brakes are operative, and
- 7) Flight performance penalty is applied.

The emphasized categorical requirements in points above 2), 4) and 5) have been irrevocably eliminated at the moment of the failure and the loss of „Green” hydraulic system, which means that at 05:46 h., at an altitude below 1900 ft by radio altimeter (Flt Phase 6), the aircraft in this condition has already been in trouble regarding the normal control, requiring particular attention by the crew.

The short (12 s) appearance of ECAM warning signal during the final approach, at a altitude between 1292 ft and 1152 ft, was ascertained by the crew and the messages in the relevant ECAM

pages HYDRAULIC and STATUS were checked. Crew decides to continue descent instead to cancel approach because of lack of necessity of corrective actions in the control card.

The complete loss of Green hydraulics occurred 35 seconds later, at an altitude of 740 ft, in the "inhibit phase".

After touchdown, the crew noticed partial spoiler activation and no activation of engine No 1 reverser. Only the right engine reverser was activated. Nose landing gear control did not respond. Both pilots had not taken into account that with the loss of the Green hydraulics, the capabilities for deceleration of the aircraft were only as follows:

- 50% of the left-hand landing gear brake efficiency due to the deactivated braking device No 1;
- 100% braking efficiency of the right-hand landing gear of the alternative braking system;
- the remaining 3 spoilers 2, 3 and 4 (1 & 5 didn't work on both wings);
- the right engine reverser.

The analysis, focusing primarily on the technical aspects as immediate prerequisites for the occurrence:

Normal landing gear retraction and extension are provided by the Green Hydraulic Power. Yet in the process of extending the landing gear, due to a ruptured flexible hose of RH MLG Downlock Actuator, at a working pressure of 3000 psi, for about 35-40 seconds, the entire contents of "green" hydraulic reservoir was sucked out and dumped into the atmosphere. All landing gears were still successfully extended and were mechanically locked in down position. At 05:46 h, an ECAM Message "HYD G RSVR LO LVL" appears for a few seconds, when the GREEN hydraulic fluid level fell at 3.5 lt inside the Reservoir (normal level is 14.5 lt). At this time Pressure was normal and stayed normal until 05:47:24 when a Low Pressure signal occurs because the pump sucked air from the empty reservoir. As the engine pump was the only source of pressure in GREEN hydraulics, at the same time (05:47:24h) a message was emitted about total loss of entire GREEN hydraulics - ECAM Message "HYD G SYS LO PR". All subsequent messages and failures registered in Post Flight Report (PFR) were directly attributable to this major failure, as a critical role in the developments after the touchdown was the loss of nose wheel steering signalled at 5:49 am. - "WHEEL N/W STRG FAULT".

With the loss of "green" hydraulics, the following things got up completely unusable, without any alternative:

- Normal braking system;
- Auto braking system;
- ENG 1 Thrust Reverser,
- Nose Wheel Steering.

Primary and Secondary Flight Controls were affected, but they have multiple reservation and aircraft controllability was fully operational.

The landing was performed without nose wheel control, left-hand engine reverser and with availability of only one operational braking device at the left-hand main landing gear. In this configuration, it was evident that with fully engaged right-hand engine reverser combined with 100% braking at the right-hand main landing gear and about 50% at left, creates a strong asymmetrical torque to the right-hand direction. An additional factor for this torque was the arm between the right engine and the right main landing gear.

With view to above on the second hypothesis, the following conclusion might be drawn:

The broken hydraulic hose of RH MLG LOCK-STAY ACTUATING CYLINDER resulted in loss of the hydraulic fluid of "green" hydraulics and hence to its complete break-down, resulted in non-operational state of some systems and controls.

With regard to the third hypothesis – pilot's mistakes and omissions in flight management:

For the analysis of crew actions, the following was taken into consideration:

- The ASR and statements of both pilots;
- Flight Crew Documents;
- Information about flight time, duty time and crew rests provided by AO;

- MEL - Minimum Equipment List of SX-ORG aircraft;
- Post Flight Report (PFR) – recorded messages and failures;
- DFDR analysis;
- Weather information before and during the flight;
- FCOM, OM, QRH and MEL, related to the aircraft hydraulic systems and their operation.

During the analysis of this hypothesis, the Commission found the following:

- The flight was performed by a standard crew, consisting of a commander and a first officer with the necessary training and experience for the functions they perform. Their licenses and medical certificates were valid, issued in accordance with the requirements of EASA. The commander had a total experience of over 13,200 hrs, of which 2850 hrs flown on the A320 aircraft, while the first officer had totally 735 hrs, of which 521 hrs flown on A320.

- Flight proficiency checks and simulator training were performed on a regular basis and in accordance with regulatory control requirements.

- The information provided about working and rests hours showed, that the pilots were planned in full compliance with the requirements of Regulation 965/2012, Subpart ORO.FLT. There were no preconditions for accumulated fatigue having in mind the long rest before flight, the relatively short flight time and the lack of weather and navigational complications.

In the analysis, the crew actions were divided into three phases – pre-flight preparation, flight phase and final phase.

The dispatching of the aircraft with one inoperative and deactivated braking device on a main landing gear affected the aircraft performance, associated with recalculating the required accelerated-stop distance, and required landing distance, without usage of the automatic braking system (AUTO BRAKE) because of lack of requiring efficiency of the systems mentioned above.

The other brake device on the same main landing gear was worn almost completely, but still in affordable limits. Both right-hand MLG brakes were new, installed the previous day. And this means that the braking performance of left-hand main landing gear is 50%, while on the right-hand MLG it is at full 100%. These elements from the external aircraft inspection are mandatory in pre-flight preparation and the crew did take note of their peculiarities before signing the TLB by the commander, as it should. This state of brakes and the above-mentioned limitations in MEL 32-42-01A should be analysed with increased attention, included in pre-flight briefing, with recalculation of aircraft performance data (weight limits, speeds and required RWY distances), as well unusual aircraft behaviour in case of need of intensive braking.

At the final phase of the flight, after the touchdown, the aircraft had an inoperative reverser at the side of deactivated braking device, and with no possibility to use nose wheel steering. This was not a problem to keep the direction safely, to stop within the runway if the Alternate Braking system was operating normally and if the crew was prepared, that means the crew should analyse the situation, and to perform the necessary actions in a calm straight flight stage according to QRH, OM and FCOM.

According to DFDR analysis, after touchdown the PF attempted to use a full reverse of both engines to decelerate the aircraft and with maximum braking, pressing the pedals in a varying asymmetrical (more braking at LH brake) and symmetrical sequence. As a result of Green hydraulics failure, only ENG 2 Thrust Reverser was activated, which creates a right-hand torque. The braking moment of both right-hand brakes was also greater than the one of the single left-hand brake device.

This veering moment should be compensated by using:

- the rudder,
- nose wheel steering (which is INOP due to HYD FAIL),
- asymmetrical use of brakes.

The rudder was effective in keeping landing roll direction at a speed higher than 60kts. After that the aircraft started gradually to turn to the right, the piloting pilot attempted split use of braking for a moment with a rudder fully deflected to the left, but left-hand braking device was insufficient to compensate the torque of high effective right-hand brakes and the right-hand engine reverser, still

running at maximum reverse thrust. In such a case, the running reverser must be turned off or reduce its thrust and reduce the pressure on the right-hand brakes using the left-hand brake pressure to keep the direction and deceleration. It was possible that pushing again and keeping maximal pressure on right-hand brakes and full thrust of the right reverser, the pilot had tried to decelerate the aircraft more quickly, but this increased airplane veering to the right and predetermines the RWY excursion.

These CM1 actions indicate that the crew was unprepared for such concatenation of circumstances and had no clear idea about LDA. In fact, RWY length is 3200 m and it is enough for normal stopping without intensive use of brakes and without use of reversers. According to the Landing Performance Chart with one deactivated braking device, Actual Landing Distance will rise to 950 meters and the Required Landing Distance will be 1583 meters. Some recalculation was performed by the crew before the flight in accordance with MEL. During the flight and before descent such a scenario also wasn't considered in details, and they turned out to be unprepared and their actions were subsequently wrong.

In line with the said in the third hypothesis, it could be concluded that the flight crew contributed to escalation of the emergency resulting from the technical failure.

In view of the above, it can be concluded that the serious incident under investigation was most probably a result of the dominant factors related to the above discussed hypotheses 2/3, as follows:

1. Green hydraulic system failure due to mechanical damaged hose, supplying RH MLG LOCK-STAY ACTUATING CYLINDER, resulted in loss of hydraulic quantity and subsequent complete failure of the same, affecting operation of some other systems and flight controls;
2. Aircraft older design configuration with Nose Wheel Steering supply from Green Hydraulic system instead of Yellow, like in later A320 aircraft configurations;
3. CRM deficiencies that resulted in incomplete analysis of the ECAM messages and wrong decision to continue the landing approach without full assessment of the situation;
4. Wrong pilot's actions after touchdown, resulting in inability to maintain the direction along the RWY centre line.

4. Conclusion

4.1. Findings

1. A320-232 with registration SX-ORG, serial number 1407, is produced in 2001 by AIRBUS SAS and operated by AO "ORANGE2FLY", hired under a contract from AO "SMART WINGS". Aircraft total flight hours until the moment of the serious incident are 35407:38 FH.
2. A320-232 with registration SX-ORG is airworthy and prepared for the concrete flight at the time of aviation occurrence according to recorded in TLB, MEL 32-42-01 (Main wheel brake) and 32-42-05A (Auto brake deactivated).
3. The flight crew of A320-232 consists of a commander and a first officer, appropriately qualified and in medical fitness for the flight in accordance with the existing regulations.
4. There is no evidence about crew efficiency loss during the event.
5. This serious incident is not caused by adverse weather conditions.
6. In the pre-flight briefing, the flight crew correctly accepted dispatch with one left-hand brake deactivated.
7. The flight was normal, with no technical failures or operational deficiencies, up to the final approach when Green Hydraulic System Failures with ECAM inhibition to crew occurred.
8. When first messages for hydraulics malfunctions occurred, the crew did not stop descending to assess the situation and eventual follow-up activities.
9. The crew awareness on faulty systems seems to come late, at a critical high workload phase just before touchdown (347 ft RA) due to LO PRESS fault inhibition, not providing time for full aircraft system status assessment.
10. The flight crew has been surprised by the Green hydraulics failure and the subsequent malfunctions in the controls after touchdown.

11. The flight crew did not act fully adequately in the situation; their actions have been hasty in the quest of rapidly reducing speed after touchdown and did not react adequately to keep the RWY direction of rolling for safe stopping within the runway.

12. Aircraft design configuration having Nose Wheel Steering system supply on Green hydraulic system, instead of Yellow like in newer A320 aircraft design configurations, was a dominant factor to the RWY excursion.

13. The Emergency Plan of Burgas Airport is immediately activated, but after an assessment of the situation, no emergency actions have been latter on.

4.2. Causes:

1. Green hydraulic system failure due to hydraulic leak during approach for landing and as a result failures affecting the aircraft control and performance during rollout after landing.

2. Pilot's incorrect actions in landing phase after touchdown, resulting in inability to maintain the runway centre line direction under conditions of complete failure of Green hydraulic system, as incorrectly use of maximal brakes and full power of right engine reverser, while having a reduced braking effect of the left brakes.

3. CRM, during a high workload flight phase with multiple technical failures and warning inhibition to the crew by aircraft design, led to wrong decision to continue approach for landing and therefore the crew did not perform an assessment of possible malfunctions of flight controls timely.

5. Safety Recommendations:

As a result of the preliminary analysis of the event, on January 10, 2018, AO ORANGE2FLY informed the Commission about internal precautions taken:

1. All flight crews should, on the next recurrent training, have that serious incident discussed during briefings and demonstrated in the simulator in order to raise situation awareness.

2. The flight crew involved in that serious incident followed the training department decision for ground school and additional simulator session.

Whereas the causes of the serious incident and the deficiencies and shortcomings discovered during the investigation, the safety investigation commission considers that the measures taken by the operator are sufficient. The safety investigation commission does not propose any other safety recommendations related to this occurrence.

Commission on Investigation of the serious incident

AIR, MARITIME AND RAILWAY ACCIDENTS INVESTIGATION NATIONAL BOARD

Sofia, 8 February 2021

APPENDIX 1



Fig.1



Fig .2



Fig. 3



Fig. 4



Fig. 5

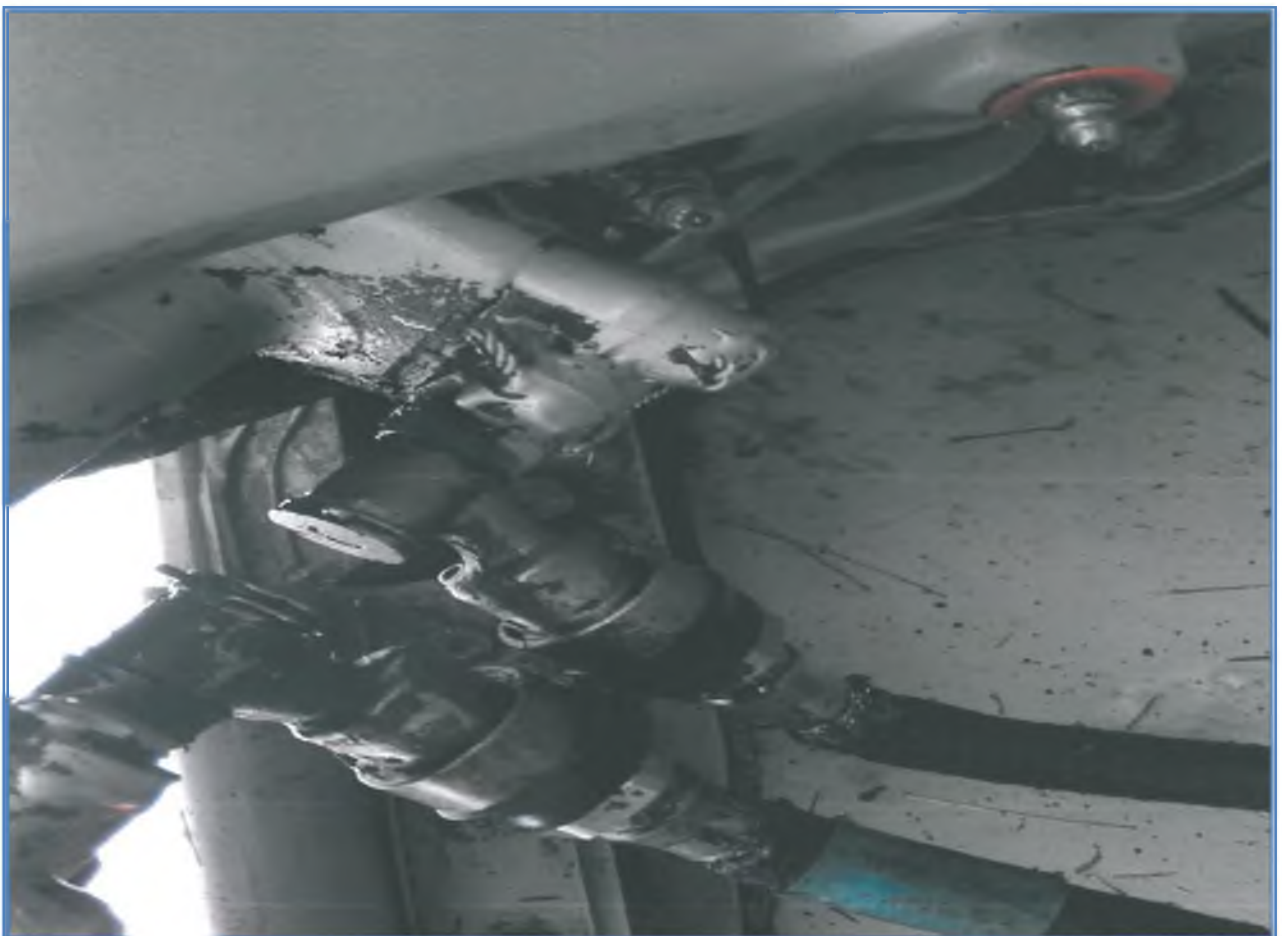


Fig. 6



Fig. 7



Fig. 8





Fig. 9



Fig. 10

APPENDIX 2


A318/A319/A320/A321 FLIGHT CREW TECHNIQUES MANUAL	AIRBUS OPERATIONAL PHILOSOPHY MANAGEMENT OF ABNORMAL OPERATIONS HANDLING OF ECAM/QRH/OEB
<p>In all cases, the flight crew must stop the ECAM actions before reading the STATUS page, in order to:</p> <ul style="list-style-type: none"> - Perform the After Takeoff/Climb C/L or any normal C/L, if applicable. The flight crew must perform the pending normal C/L at this stage as it is a good compromise between the necessary application of ECAM procedures and system analysis and the delay in the check of systems status (e.g. in the case of failure after takeoff, flaps and landing gear retracted) - Consider any system reset. The ECAM procedure may consider reset of the system by switching OFF then ON the associated system via the usual cockpit control. However reset action may not be requested by the ECAM procedure. In this case, it is the flight crew responsibility to consider any system reset to recover the operation of the affected system, provided that the system reset is permitted in the system reset table. If the reset is successful, the STATUS page will disappear. The flight crew must not apply the system reset procedure from memory. They must refer to the QRH. - Consider application of the ENG RELIGHT procedure after an engine failure with no damage. The flight crew should consider performing the ENG RELIGHT procedure at this stage as if the relight is successful the STATUS page will disappear. <p><u>STATUS PAGE</u></p> <p>The purpose of the STATUS page is to provide an overview of the technical status of the aircraft in all flight phases. Therefore, it is important that the flight crew checks the whole STATUS page information, in order to correctly assess the situation and subsequently make appropriate decision. The STATUS page may contain some actions, that should be performed by the flight crew at a more appropriate time. The flight crew should read the procedures associated with the STATUS page during the STATUS page review to evaluate and anticipate the workload for each flight phase.</p>	
Ident: AOP-30-30-A-00021503.0001001 / 20 MAR 17	
<p><u>IF THE ECAM WARNING (OR CAUTION) DISAPPEARS</u></p> <p>If an ECAM warning disappears while a procedure is being applied, the warning can be considered no longer applicable. Application of the procedure can be stopped. For example, during the application of an engine fire procedure, if the fire is successfully extinguished with the first fire extinguisher bottle, the ENG 1(2) FIRE warning disappears and the procedure no longer applies. Any remaining ECAM procedures should be performed as usual.</p>	
HANDLING OF QRH	
Ident: AOP-30-30-00021497.0001001 / 20 MAR 17	
Applicable to: ALL	
<p><u>GENERAL</u></p> <p>When the flight crew needs to apply a QRH procedure, the PM should use the QRH/Abnormal and Emergency Procedures table of contents in order to search and select the applicable procedure.</p>	
A318/A319/A320/A321 FLEET	AOP-30-30 P 4/6
FCTM	MAR 17
← C to D →	

 A318/A319/A320/A321 FLIGHT CREW OPERATING MANUAL	PROCEDURES ABNORMAL AND EMERGENCY PROCEDURES HYD
HYD G RSVR LO LVL	
Applicable to: ALL Ident.: PRO-ABN-HYD-F-00017142.0002001 / 21 MAR 16	
ANNUNCIATIONS	
Triggering Conditions: This alert triggers when the fluid quantity < 3.5 l (0.92 US Gal). Flight Phase Inhibition:	
	
Note: The HYD G RSVR LO LVL alert is inhibited for the first 15 s of flight phase 5. Ident.: PRO-ABN-HYD-F-00011614.0002001 / 05 MAR 13	
PTU.....OFF GREEN ENG 1 PUMP.....OFF G ENG 1 PUMP LO PR.....OFF	
ASSOCIATED PROCEDURES	
G SYS LO PR FUEL CONSUMPT INCRSD FMS PRED UNRELIABLE	
SECONDARY FAILURES *WHEEL *F/CTL	
Continued on the following page	

OTF A318/A319/A320/A321 FLEET
FCOM

H →

PRO-ABN-HYD P 14/48
07 JUN 17

 A318/A319/A320/A321 FLIGHT CREW OPERATING MANUAL	PROCEDURES ABNORMAL AND EMERGENCY PROCEDURES HYD
HYD G RSVR LO LVL (Cont'd)	
Ident.: PRO-ABN-HYD-F-00018320.0006001 / 21 MAR 17	
STATUS	
L/G..... GRVTY EXTN Refer to PRO-ABN-LG [QRH] L/G GRAVITY EXTENSION LDG DIST PROC..... APPLY FUEL CONSUMPT INCRSD See ⁽¹⁾ FMS PRED UNRELIABLE See ⁽²⁾ ALTN Y BRK WITH A/SKID SLATS/FLAPS SLOW CAT 3 SINGLE ONLY	INOP SYS GREEN HYD SPLR 1 + 5 CAT 3 DUAL NW STRG AUTO BRK NORM BRK L/G RETRACT REVERSER 1 YAW DAMPER 1
⁽¹⁾ This message is triggered when the failure (or combination of failures) affects the nominal aerodynamic characteristics of the aircraft. ⁽²⁾ Disregard FMS fuel predictions and refer to QRH/OPS Operational Data - Fuel Penalty Factors Tables in order to find the applicable Fuel Penalty Factor.	

5.5 BURGAS landing performance with one brake unit deactivated

A320232 - JAA		IAE VISA41 register		BURGAS BURGAS BOJ - LB80			04		30.00 16.00.17	
AT DISPATCH QNH 1017.00 hPa Airfield On Anti-icing 1248 All instruments operating 1. Brake temperature 100% minimum No windmills on the runway				ELEVATION 60 FT 184 (604) 116 C RWY slope 0.3 1 1% TORA 1200 M					ARJICL VOR 131V CSRP FULL GA CONF 3	
CAT	TAILWIND -10 KT	TAILWIND -5 KT	WIND -5 KT	HEADWIND -5 KT	HEADWIND 10 KT	HEADWIND 15 KT	HEADWIND 20 KT	HEADWIND 25 KT	HEADWIND 30 KT	
-8	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	
-7	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	
-6	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	
-5	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	
-4	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	
-3	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	
-2	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	
-1	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	
0	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	
1	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	
2	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	
3	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	
4	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	
5	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	
6	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	
7	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	
8	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	
9	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	
10	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	
11	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	
12	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	
13	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	
14	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	
15	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	
16	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	
17	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	
18	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	
19	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	
20	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	
21	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	01.0 131	
INFLUENCE OF RUNWAY CONDITION										
WXY	00 0	00 0	00 0	00 0	00 0	00 0	00 0	00 0	00 0	
DQW/RW	00 0	00 0	00 0	00 0	00 0	00 0	00 0	00 0	00 0	
INFLUENCE OF DELTA PRESSURE										
-10.0	00 0	00 0	00 0	00 0	00 0	00 0	00 0	00 0	00 0	
-15.0	00 0	00 0	00 0	00 0	00 0	00 0	00 0	00 0	00 0	
-20.0	00 0	00 0	00 0	00 0	00 0	00 0	00 0	00 0	00 0	
VFA based calculation										
VFA 0.1 KT/1000 KG	1-max weight 2-landing distance 3-approach climb									
	4-landing climb 5-true speed 6-braking energy									
LABEL FOR INFLUENCE NO COMBINATION: DW(1000KG) DVFA(KT)										
COMBINE: DW(1000KG) DVFA(KT)										