AIRCRAFT ACCIDENT REPORT

OLA/2014/11/29/F

Accident Investigation Bureau

Draft Final Report on the serious incident involving ATR 72 aircraft with nationality and registration marks 5N-BPG owned and operated by Overland Airways Limited which occurred at Ilorin International Airport, Nigeria on 29th November, 2014.

This report was produced by the Accident Investigation Bureau, Nigeria (AIB), Nnamdi Azikiwe International Airport, Abuja.

The report was based upon the investigation carried out by AIB, in accordance with Annex 13 to the Convention on International Civil Aviation, Nigerian Civil Aviation Act 2006 and Civil Aviation (Investigation of Air Accidents and Incidents) Regulations 2019.

In accordance with Annex 13 to the Convention on International Civil Aviation, it is not the purpose of aircraft accident/serious incident investigations to apportion blame or liability.

Readers are advised that AIB investigates for the sole purpose of enhancing aviation safety. Consequently, AIB reports are confined to matters of safety significance and should not be used for any other purpose.

The AIB believes that safety information is of great value if it is passed on for the use of others. Hence, readers are encouraged to copy or reprint reports for further distribution, acknowledging the AIB as the source.

Safety Recommendations in this report are addressed to the Regulatory Authority of the State, as well as other stakeholders, as appropriate. The Regulatory Authority is the authority that ensures implementation and enforcement.

Printed in Nigeria for the Accident Investigation Bureau (AIB)

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GLOSSARY OF ABBREVIATIONS USED IN THIS REPORT

ACW	Alternating Current Wild Frequency
AFU	Auto-Feather Unit
AFM	Airplane Flight Manual
AIB-N	Accident Investigation Bureau, Nigeria
AMM	Aircraft Maintenance Manual
AMSL	Above Mean Sea Level
ATC	Air Traffic Control
ARFFS	Aerodrome Rescue and Fire Fighting Service
BEA	Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile
C of A	Certificate of Airworthiness
CCAS	Centralised Crew Alerting System
CMC	Central Maintenance Computer
CL	Condition Lever
CVR	Cockpit Voice Recorder
DA40	Diamond 40
DNAA	ICAO location indicator for Nnamdi Azikiwe International Airport, Abuja
DNIL	ICAO location indicator for Ilorin Airport
FCOM	Flight Crew Operating Manual
FDR	Flight Data Recorder
FL	Flight Level

ft	feet
FTR	Feather
FUEL SO	Fuel Shut Off
FWD	Forward
GI	Ground Idle
HMU	Hydro Mechanical Unit
HP	High Pressure
HYD LO LVL	Hydraulic Low Level
IAC	International Aviation College
IFR	Instrument Flight Rules
ILR	Ilorin
Kt	Knot (s)
LH	Left Hand
LO LVL	Low Level
Lt	Light
MEL	Minimum Equipment List
MIN	Minimum
Nig. CARs	Nigeria Civil Aviation Regulations
NM	Nautical mile (s)
N_P	Propeller Rotation Speed
PA	Public address system

PCU	Propeller Control Unit
PF	Pilot Flying
PM	Pilot Monitoring
PL	Power Lever
PVM	Propeller Valve Module
QAR	Quick Access Recorder
QRH	Quick Reference Handbook
RPM	Revolution per minute
RWY	Runway
TQ	Torque
TWR	Tower
UTC	Coordinated Universal Time
VMC	Visual Meteorological Conditions
VOR	VHF Omnidirectional Radio Range

Aircraft accident report number:	OAL/2014/11/29/F
Registered owner and operator:	Overland Airways Limited
Aircraft type and model:	ATR 72-202
Manufacturer:	ATR AVIONS DE TRANSPORT REGIONAL France/Italy
Year of manufacture:	1993
Serial number:	365
Nationality and registration marks:	5N-BPG
Location:	Runway 05, Ilorin International Airport,
Date and time:	29th November, 2014 at 16:44 h (*All times in this report are local time (UTC +1), unless otherwise stated*)

SYNOPSIS

Accident Investigation Bureau, Nigeria (AIB) was notified of the occurrence by the operator on 29th November, 2014. Investigators were dispatched to the site the next day.

On 29th November, 2014 at 15:43 h, an ATR 72 aircraft with nationality and registration marks 5N-BPG operated by Overland Airways Limited with call sign OLA1186 departed Nnamdi Azikiwe International Airport, Abuja (DNAA) on a scheduled passenger flight for Ilorin International Airport, (DNIL) on an Instrument Flight Rules (IFR) flight plan. Onboard were 63 persons, inclusive of 2 cockpit crew and 2 cabin crew. The Pilot was the Pilot Flying (PF) and the Co-Pilot was the Pilot Monitoring (PM).

At 15:50 h, at about 7,000 ft during climb, the flight crew stated that, the LO LVL (low

Level) light of the Blue Hydraulic System came ON. The checklist was used and the flight continued.

At 16:30 h, while on final approach, the flight crew observed that the LO LVL light of the Green Hydraulic System also came ON.

At 16:43:02 h, OLA1186 touched down well aligned with RWY 05.

At 16:43:23 h, OLA1186 veered off the runway at low speed into the grass verge, hit a ridge and its nose gear collapsed. At 16:43:28 h, OLA1186 came to a stop at a distance of 4,400 ft from RWY 05 threshold, 40 ft from the edge of RWY 05 with its tail 12 ft from runway shoulder. The engines were shut down by pulling the ENG FIRE handles as the condition levers were jammed. The crew and passengers were evacuated uninjured.

The incident occurred in daylight and Visual Meteorological Conditions (VMC) prevailed.

Causal factor

Loss of directional control on ground due to the aircraft being dispatched with one brake inoperative and loss of both hydraulic systems in flight.

Contributory factor

Inappropriate application of the Standard Operating Procedures (SOP) following the display of HYD LO LVL indication of the Blue hydraulic system shortly after takeoff.

No safety recommendation was made.

1.0 FACTUAL INFORMATION

1.1 History of the flight

On 29th November, 2014 at 15:43 h, an ATR 72 aircraft with nationality and registration marks 5N-BPG operated by Overland Airways Limited with call sign OLA1186 departed Nnamdi Azikiwe International Airport, Abuja (DNAA) on a scheduled passenger flight for Ilorin International Airport, (DNIL) on an Instrument Flight Rules (IFR) flight plan. Onboard were 63 persons, inclusive of 2 cockpit crew and 2 cabin crew. The Pilot was the Pilot Flying (PF) and the Co-Pilot was the Pilot Monitoring (PM). The aircraft departed with a deactivated left main wheel brake assembly, whose rectification was deferred in accordance with the approved Minimum equipment list (MEL).

At 15:50 h, at about 7,000 ft during climb, the flight crew stated that, the LO LVL (Low Level) light of the Blue Hydraulic System came ON; the HYD LO LVL (Hydraulic Low Level) checklist of the ATR 72 Quick Reference Handbook (QRH) was accomplished and the flight continued. Flight Data Analysis indicates that the ACW electric motor driven pump was not switched OFF and that the BLUE PUMP LO PRESS alert displayed several times along the flight.

At 16:01 h, OLA1186 established contact with Ilorin Tower (TWR) and was cleared to ILR VOR approach Runway (RWY) 05.

At 16:14 h the aircraft requested for descent and was cleared FL060 to report 30 NM to the VOR.

At 16:21 h the aircraft reported 30 NM, requested further descent and clearance for Straight-in VOR approach RWY 23 which was not granted due traffic on approach 16 NM RWY 05.

At 16:23 h, OLA1186 again requested clearance for Straight-in VOR approach RWY 23. TWR instructed the aircraft to reduce speed and make an orbit at 20 NM to the field to accommodate the traffic landing on RWY 05; which was acknowledged.

After the orbit, at about 16:27 h OLA1186 was cleared to intercept centerline RWY 23, descend to 3500 ft and report RWY in sight.

At 16:30 h, on final approach after landing gear extension, the flight crew observed that the LO LVL light of the Green Hydraulic System came ON. While maintaining 3500 ft, the flight crew informed TWR that they were having problems and requested to join the hold overhead 'ILR' VOR to allow them deal with the failures and to complete the HYD LO LVL and BOTH HYD SYS LOSS checklists of the ATR 72 QRH.

At 16:36 h, OLA1186 requested for the position of traffic and the only traffic mentioned was a Diamond 40 (DA40) training aircraft with registration marks 5N-BNJ, maintaining 4000 ft at 15 NM to the field operating at area 4C[1].

OLA1186 requested priority landing on RWY 05, as there was a problem with the hydraulic systems. 5N-BNJ was instructed to vacate the south eastern part of the field and fly to the northern part of the field for their training.

At 16:37 h, TWR informed ARFFS of OLA1186 position, hydraulic system problem and the runway in use.

At 16:39 h, OLA1186 reported 8 NM final RWY 05 and TWR instructed the aircraft to report field in sight.

At 16:41 h, 6 NM to touch down, OLA1186 reported field in sight and was cleared to land

[1] 4C is the International Aviation College designated flight training area, located southeast of the airfield.

RWY 05, wind 120° at 05 knots and to check three greens, which the flight crew acknowledged.

At 16:43:02 h, OLA1186 touched down RWY 05.

The flight crew reported that during the landing roll, the emergency braking was applied and asymmetric braking[2] was felt.

At 16:43:05 h, the flight crew applied rudder pedal to turn to the left and the aircraft continued to veer to the right. As the airspeed decreased below 70 kt, the flight crew lost directional control of the aircraft.

At 16:43:23 h, OLA1186 veered off the runway at low speed into the grass verge, hit a trench and its nose gear collapsed. The aircraft came to a stop at a distance of 4,400 ft from RWY 05 threshold, 40 ft from the edge of RWY 05 with its tail 12 ft from the runway shoulder. The engines were shut down by pulling the ENG FIRE handles as the condition levers were jammed. The ARFFS responded appropriately.

The crew and passengers were evacuated uninjured.

The incident occurred in daylight and Visual Meteorological Conditions (VMC) prevailed.

[2] Asymmetric braking is when all brakes on one landing gear are released while the remaining brakes are applied thereby swinging the aircraft in the direction of the applied brakes.

1.2 Injuries to persons

Injuries	Crew	Passengers	Total in the aircraft	Others
Fatal	Nil	Nil	Nil	Nil
Serious	Nil	Nil	Nil	Nil
Minor	Nil	Nil	Nil	Not applicable
None	4	59	63	Not applicable
Total	4	59	63	Nil

1.3 Damage to aircraft

The aircraft was substantially damaged.

1.4 Other damage

Nil

1.5 Personnel information

1.5.1 Pilot

Nationality:	Zambian
Age:	61 years
License type:	Airline Transport Pilot License (Aeroplane)
License validity:	Valid till 15th May, 2016
Aircraft ratings:	ATR 72, ATR 42, Beechcraft BE-1900

Medical certificate:	Valid till 13th December 2014
Simulator validity:	Valid till 10th December 2014
Instrument rating:	Valid till 1st December 2014
Total flying time:	14,485 h
Total on type:	8,607 h
Total on type (PIC):	7,787 h
Last 90 days:	26 h
Last 28 days:	17 h
Last 24 hours:	3:15 h

1.5.2 Co-Pilot

Nationality:	Nigerian
Age:	39 years
License type:	Commercial Pilot License (Aeroplane)
License validity:	Valid till 13th May 2017
Aircraft ratings:	ATR 72, ATR 42
Medical certificate:	Valid till 14th April 2015
Simulator validity:	Valid till 23rd April 2015
Instrument rating:	Valid till 24th April 2015
Total flying time:	1,522 h
Total on type:	1,240 h
Last 90 days:	69:15 h

Last 28 days:	17:02 h
Last 24 Hours:	03:15 h

1.5.3 Purser

Nationality:	Nigerian
Age:	38 years
License type:	Cabin Crew License
License validity:	Valid till 9th October 2016
Aircraft ratings:	ATR 72, ATR 42, B747-200/300
Medical Certificate:	Valid till 9th September 2015

1.6 Aircraft information

1.6.1 General information

Type:	ATR 72-202
Manufacturer:	ATR AVIONS DE TRANSPORT REGIONAL France/Italy
Year of manufacture:	1993
Serial number:	365
Operator:	Overland Airways Limited
Nationality and registration marks:	5N-BPG
Certificate of Airworthiness:	Valid till 18th September 2015

Certificate of Insurance:	Valid till 3rd September 2015
Certificate of Registration:	Issued 5th September 2013
Noise Certificate:	Issued 10th September 2013
Total airframe time:	37,166.47 h
Total landing/cycles:	45,351

1.6.2 Power plants

Engine	**Number 1**	**Number 2**
Manufacturer	Pratt and Whitney, USA	Pratt and Whitney, USA
Type/Model	PW 124B	PW 124B
Serial number	124660	124542
Time Since New	7,400.53 h	2,667.32 h
Cycles Since New	Not available	2,031

1.6.3 Propeller

Propeller	**Number 1**	**Number 2**
Manufacturer	Hamilton Sundstrand, USA	Hamilton Sundstrand, USA
Type/Model	14 F-11	14 F-11
Serial number	921221	900712
Hours	2,667:32 h	3,180:32 h

Fuel Used: Jet A1

The ATR 72 has a maximum take-off weight of 21,472 kg and a maximum landing weight of 21,350kg. The aircraft take-off weight was 20,065kg and landing weight was 19,428kg.

1.6.4 ATR 72 Hydraulic system description

Below are excerpts taken from the ATR 72 Flight Crew Operating Manual (F.C.O.M) 1st Part: SYSTEM DESCRIPTION Revision 35 of September 2013; Section 1.12.10; pages P1, P2 & P7/8.

HYDRAULIC SYSTEM *(GENERAL)*

10.1 DESCRIPTION

The aircraft has two hydraulic systems, designated blue and green.
The common hydraulic tank is located in the hydraulic bay (LH landing gear fairing).

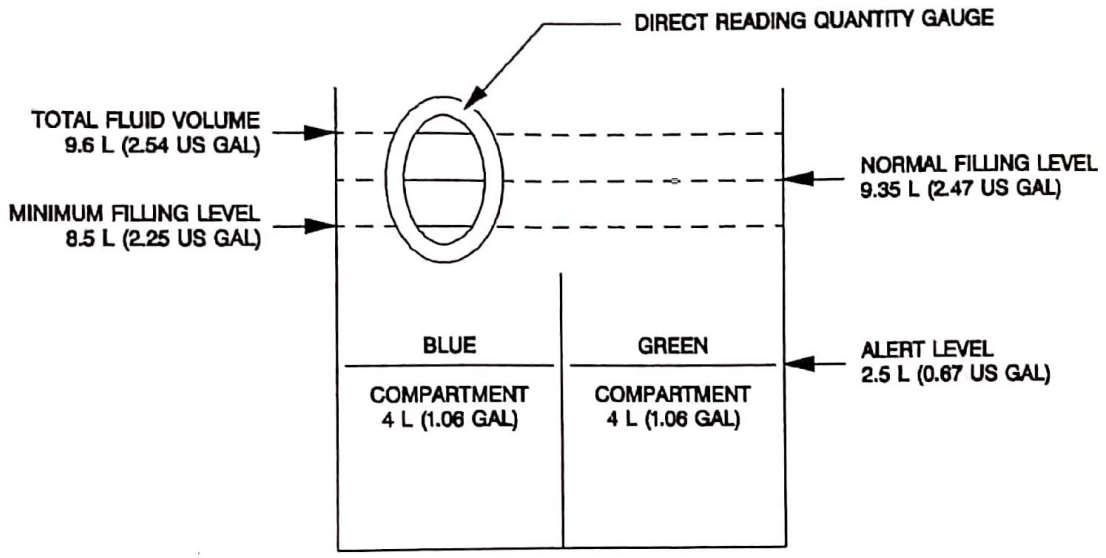

Figure 1: Hydraulic system tank

The tank is a direct air-fluid contact type and is not pressurised. A compartment baffle ensures fluid anti-splashing and limits fluid foaming.

A direct reading quantity gauge is located on the tank. A low level alert is provided for each compartment when quantity drops below 2.5 l (0.67 US gal).

Power Generation

Each system is pressurised by an ACW electric motor driven pump. Delivery pressure of each pump is displayed. Normal operating pressure is 3000 PSI (206.9 bars). The blue circuit is also fitted with an auxiliary DC motor driven pump.

Each system is provided with a 0.2 l (0.05 US gal) power accumulator installed in the hydraulic bay. They damp pump delivery pulsations and any pressure surges and compensate for pump response time in the event of high output demand.

On the ground, when no electric power is available, hydraulic power may be generated by a hydraulic ground power unit, through a ground connector located in the hydraulic bay. A ground switch on the pedestal enables to energize the auxiliary pump even when no electrical power is available.

Users

The blue system supplies:

- *wing flaps extension/retraction:*
- *four wing flap actuating hydraulic jacks.*
- *spoilers*
- *two spoilers actuating hydraulic jacks*
- *nose wheel steering:*

- *one steering hydraulic jack.*
- *propeller brake for the RH engine.*
- *emergency and parking braking for the four main landing gear wheels through a specific accumulator with separate pressure indicator.*

The green system supplies:

- *landing gear extension/retraction:*
- *three landing gear actuating hydraulic jacks*
- *three landing gear uplock release actuators*
- *three landing gear downlock release actuators*
- *normal braking for the four main landing gear wheels*

In case of hydraulic pump failure, the associated system users may be supplied by the other pump by opening the cross-feed valve.

Note: In case of LO LEVEL alert, cross feed valve:

- is inhibited to open

- closes automatically if it was in open position

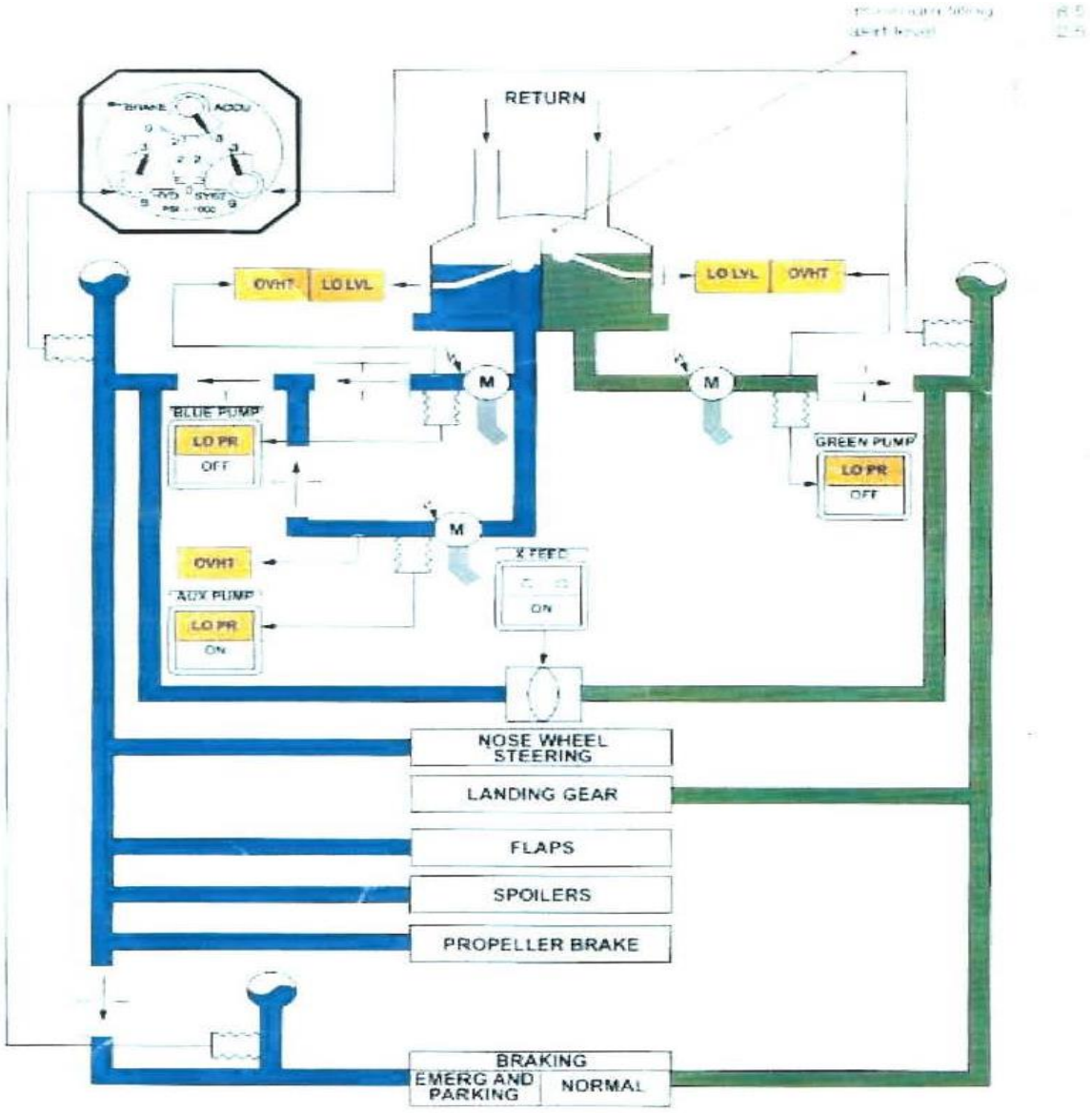

Figure 2: Hydraulic system schematic of ATR 72

1.6.5 Emergency braking

Emergency braking has been made operationally easier by design of the parking brake lever which incorporates an "EMER BRAKE" notch: when the parking brake lever is set in this

notch, the regulator delivers a limited pressure which:

- *allows the use of EMER BRAKING for abort take-off at max V1 or at touch down for landings after GREEN pressure has been completely lost.*
- *Provides repeatable, smooth deceleration whilst minimizing the risk of blown up tires.*

CAUTION: Use of EMER BRAKE beyond the EMER BRAKE NOTCH ABOVE 60 Kts MUST BE AVOIDED TO PREVENT WHEELS LOCK UP AND DAMAGES TO WHEELS AND TIRES. BELOW 60 Kts, a SMALL further travel (- 1cm) IS AVAILABLE WITHOUT RISKS OF DAMAGE WHEN STOPPING PERFORMANCE IS REQUIRED.

1.6.5.1 Emergency/Parking Brake Handle

The Emergency/ Parking brake handle controls emergency and parking brake mode through the emergency and parking metering valve. Spring loaded to the OFF position.

EMER A metered pressure is applied to the brakes.

PARKING Full pressure is applied to the brakes.

CAUTION: Brake handle applies braking without any antiskid operation.

Note: In case of hydraulic power system failure, the brake accumulator allows at least six braking operations.

1.6.6 ATR 72 hydraulic fuse

Each of the four fuses stops the flow of hydraulic fluid to the respective brake in the event of a line failure. The fuse allows oil flow up to 30 psi of differential pressure at its IN-OUT ports, with a self reset in 5 sec against a minimum pressure difference of 18 psi, and stops oil flow at a differential pressure beyond 30 psi. Each of the four fuses is provided with a bypass valve with a manually operated lever, actuated for maintenance purposes.

1.6.7 ATR 72 Quick Reference Handbook (QRH) "Following Failures Hydraulic" Checklists

Section 2.19 HYD LO LVL

AR 72	FOLLOWING FAILURES HYDRAULIC	2.19 OCT 08 001

HYD LO LVL

■ **If blue system affected**
BLUE PUMP ..... OFF
AUX PUMP ..... OFF (CONFIRMED)
REDUCED FLAPS LANDING procedure (2.21) ..... APPLY
● **After touch down**
USE NORMAL BRAKE FOR STEERING
TAXI ON BOTH ENGINES

■ **If green system affected**
GREEN PUMP ..... OFF
LDG DIST ..... MULTIPLY BY 1.5
Note: Refer to Part 4 to determine landing distance
LDG GRAVITY EXTENSION procedure (2.24) ..... APPLY
● **After touch down**
TAXI ON BOTH ENGINES
REVERSE ..... AS RQD
BRK HANDLE ..... EMER AS RQD

HYD SYS LOST EQUIPMENT LIST

BLUE	GREEN
FLAPS / SPOILERS / N/W STEERING PROP BRK (if applicable) EMER AND PARKING BRK (on accu only)	LDG GEAR EXT / RET NORM BRK

BOTH MAIN HYD PUMPS LOSS

MAIN BLUE AND GREEN PUMPS ..... OFF
X FEED ..... CHECK OFF
LDG DIST ..... MULTIPLY BY 1.5
Note: Refer to Part 4 to determine landing distance

● **Before landing**
LDG GEAR LEVER ..... DOWN
BLUE PRESSURE ..... CHECK
FLAPS 15 ..... AS RQD
LDG GEAR GRAVITY EXTENSION procedure (2.24) ..... APPLY
FLAPS 30 ..... AS RQD

● **After touch down**
TAXI ON BOTH ENGINES
REVERSE ..... AS RQD
BRK HANDLE ..... EMER AS RQD

BOTH MAIN HYD PUMPS LOST EQUIPMENT LIST

R R BLUE recovered when LDG GEAR lever is DOWN	GREEN
R R R FLAPS / SPOILERS / N/W STEERING PROP BRK (if applicable) EMER AND PARKING BRK (on accu only)	LDG GEAR EXT / RET NORM BRK

Section 2.20 BOTH HYD SYS LOSS

ATR 72	FOLLOWING FAILURES HYDRAULIC	2.20 OCT 08 | 001

BOTH HYD SYS LOSS

MAIN AND AUX PUMPS ..... OFF

- **Before approach**

R GPWS ..... GPWS OVRD or FLAP OVRD (depending on version)
R LDG GEAR GRAVITY EXTENSION procedure (2.24) ..... APPLY
APP/LDG SPEED ..... VmHB 0 + 5 KT + WIND EFFECT
LDG DIST ..... MULTIPLY LDG DIST FLAPS 30 BY 2.6
Note: Refer to Part 4 to determine VmHB and LDG DIST

CAUTION: Tail strike may occur if pitch attitude exceeds 8° during the flare depending upon vertical speed at touch down.

- **When reaching 10 ft**

ENG POWER ..... REDUCE PROGRESSIVELY

- **After touch down**

R REVERSE ..... AS RQD
R BRK HANDLE ..... EMER AS RQD
R TAXI ON BOTH ENGINES

BOTH HYD SYS LOST EQUIPMENT LIST

R	BLUE	GREEN
R R R	FLAPS / SPOILERS / N/W STEERING PROP BRK (if applicable) EMER AND PARKING BRK (on accu only)	LDG GEAR EXT / RET NORM BRK

HYD LO PR / HYD OVHT

PUMP affected side ..... OFF
X FEED ..... ON

Eng : PW124

1.6.8 Maintenance

According to the 5N-BPG technical logbook page, serial number 0007474 of 28th November, 2014 - a day before the occurrence, the No. 1 Brake Unit Assembly was found leaking hydraulic fluid during pre-flight inspection of the aircraft. The Brake Unit was deactivated in accordance with the Aircraft Maintenance Manual (AMM) and its rectification deferred for 10 days (Category C) in line with 32-42-1 of the ATR 72 Minimum Equipment List (MEL). See Appendix 1: Wheel brake deactivation.

5N-BPG operated six flights after the deactivation of the No.1 Brake Unit Assembly without reported technical issue during these flights.

1.7 Meteorological information

The Ilorin International Airport Meteorological Terminal Aviation Routine Weather Report (METAR) for 29th of November, 2014 is given below.

DNIL	**15:00 UTC**	**15:30 UTC**	**16:00 UTC**
Wind	070°/03 kt	070°/07 kt	060°/05 kt
Visibility	15 km	15 km	15 km
Weather	Nil	Nil	Nil
Cloud	FEW 390 m	FEW 390 m	FEW 390 m
Temp/Dew	34°C/15°C	34°C/15°C	34°C/15°C
QNH	1010 hPa	1010 hPa	1010 hPa

1.8 Aids to navigation

The conditions of the navigational aids as logged by Ilorin Tower on 29th November, 2014

were as follows:

ALDIS LAMP, CRASH ALARM & WIND VELOCITY IND.	-"Serviceable"-
ILS 'IIL' 109.9MHZ AND VOR-DME	-"Unserviceable"-
NIMET WEATHER COMPUTER	-"Unserviceable"-
VOR 'ILR' 112.3MHZ	-"Serviceable"-

1.9 Communication

There was effective communication between the aircraft and the Air Traffic Control (ATC).

The conditions of the communication aids as logged by Ilorin Tower on 29th November, 2014 were as follows:

VHF 119.6MHZ AND VHF 121.7MHZ	-"Serviceable"-
VHF MOBILE RADIO X2 & WORKSTATION 1&2	-"Serviceable"-
SATCOM, V-SAT AND AIRTEL PHONES	-"Serviceable"-

1.10 Aerodrome information

Ilorin Airport (DNIL) has Aerodrome Reference Point 08°26'24" N, 004°29'38" E and an elevation of 343 m (1,126 ft) Above Mean Sea Level (AMSL). The aerodrome has a runway orientation of 05/23. The length and width of the runway are 3,100 m and 60 m respectively, with an asphalt/concrete surface and a blast pad of 120 m at each end.

1.11 Flight recorders

The aircraft is equipped with a Flight Data Recorder (FDR) and a Cockpit Voice recorder (CVR). Both recorders were retrieved by AIB and taken to BEA (Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile) Flight Laboratory at Paris Le Bourget Airport, France for download and analysis. The recorders were in good condition and direct readouts were performed using manufacturer equipment.

BEA also got access to Central Maintenance Computer (CMC) reports and synchronised this information with the Flight Data Recorder (FDR) and Cockpit Voice Recorder (CVR) data.

Recorders	**Flight Data Recorder**	**Cockpit Voice Recorder**
Manufacturer	Fairchild, USA	Fairchild, USA
Model	SSFDR	A200S
Part number	2100-4043-00	2100-1020-02
Serial number	293664	694681
Duration	25 hours	2 h 04 min 14 s.

1.11.1 Flight Data Recorder (FDR) readout

The last recorded flight was consistent with the incident flight. The flight recorded on the FDR was also consistent with Quick Access Recorder (QAR) flight data provided to BEA by ATR.

According to the BEA FDR and CVR report number BEA2014-0046_tec01 dated 13/10/2015, there was no FDR parameter related to hydraulics or braking system. The *Flap position* parameter was not valid.

FDR Sequence of landing

UTC(FDR PLOTS)	FDR PARAMETERS	BEA COMMENTS
15 h 43 min 02s	Radio-height stabilized. Longitudinal acceleration to increase. Magnetic heading is 51°	Flare and touchdown. The aircraft was well aligned with the runway 05.
15 h 43 min 05s	Rudder position started to increase.	The crew started to give pedal order to turn to the left.
15 h 43 min 12s	Magnetic heading started to increase.	Aircraft started to veer to the right when air speed passed below 70kt. As the air speed was decreasing to a low value, the crew probably lost lateral aero dynamical control of the aircraft.
15 h 43 min 18s	Maximum rudder position is reached. Heading continued to increase.	The crew applied maximum pedal order to the left but the aircraft continued to turn to the right.
15 h 43 min 23s	Strong peaks in vertical, longitudinal and lateral acceleration. Air speed was 12 kt.	Aircraft veered off the runway at low speed.
15 h 43 min 28s	Longitudinal acceleration stabilized close to 0 g	Aircraft stopped

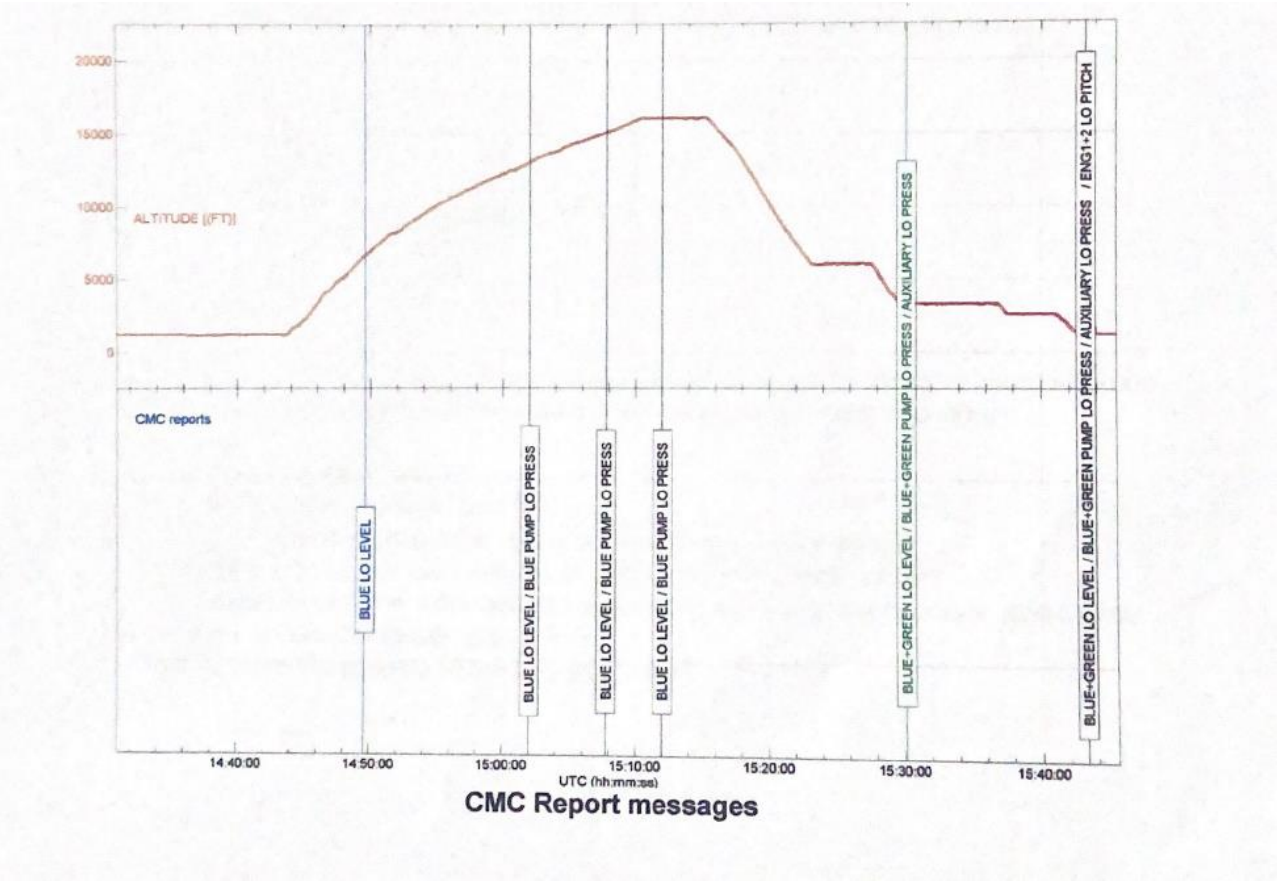

Figure 3: CMC report messages

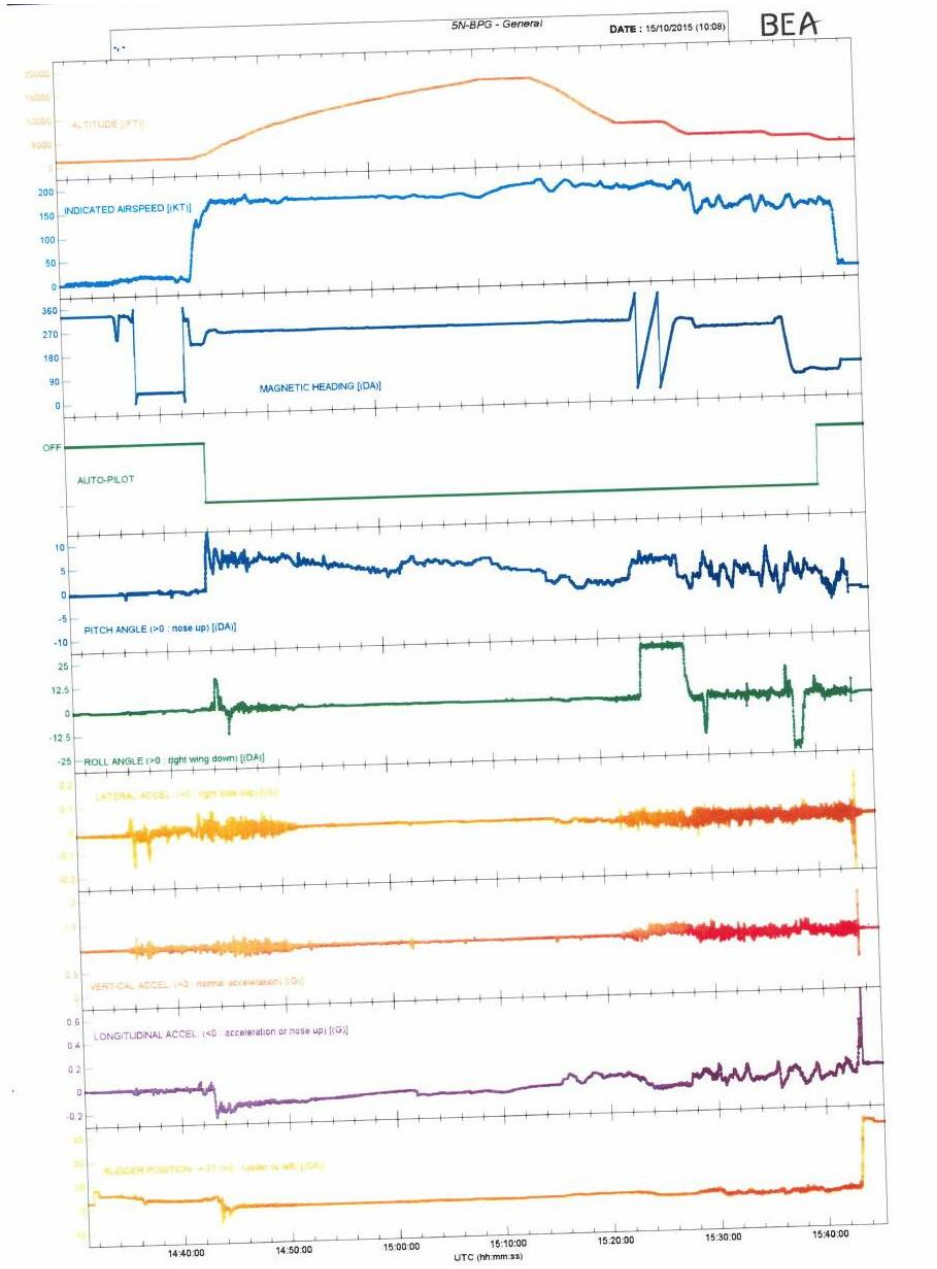

Figure 4: FDR plot 1

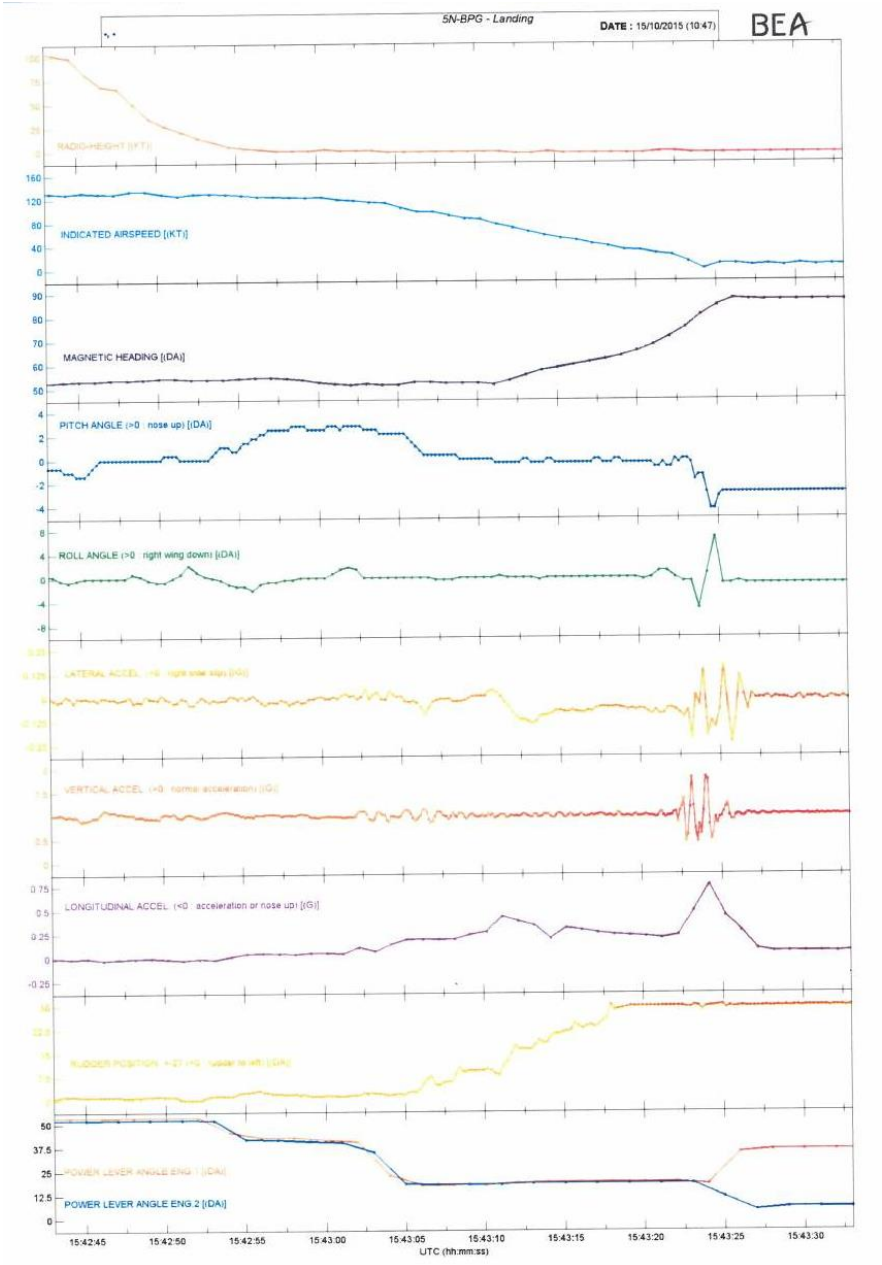

Figure 5: FDR plot 2

1.11.2 Cockpit Voice Recorder (CVR)

The download generated a raw '.cvr' file. That file was decompressed using manufacturer tools. The recording consisted in four WAV files with a total respective duration of 2 h 04 min 14 s. The recording started at 13 h 41 min 49 s UTC time. CVR audio data synchronization with FDR parameter was made by taking as reference the autopilot disconnection warning.

1.12 Wreckage and impact information

The aircraft flared and touched down well aligned with runway 05, veered off the runway at low speed into the grass verge, hit the ridges and came to a stop at a distance of 4,400 ft from RWY 05 threshold, 40 ft from the edge of RWY 05 with its tail 12 ft from runway shoulder.

Post occurrence inspection of the wreckage by the AIB investigators found that the aircraft Nose Landing Gear collapsed, the Flap Lever was at 30° position, the Power Levers were at FLIGHT IDLE position and the Condition Levers were at MIN RPM position.

Figure 6: Aircraft position after the incident

Figure 7: 5N-BPG on the grass verge

Figure 8: Aircraft with collapsed nose gear

Figure 9: Aircraft in the grass area

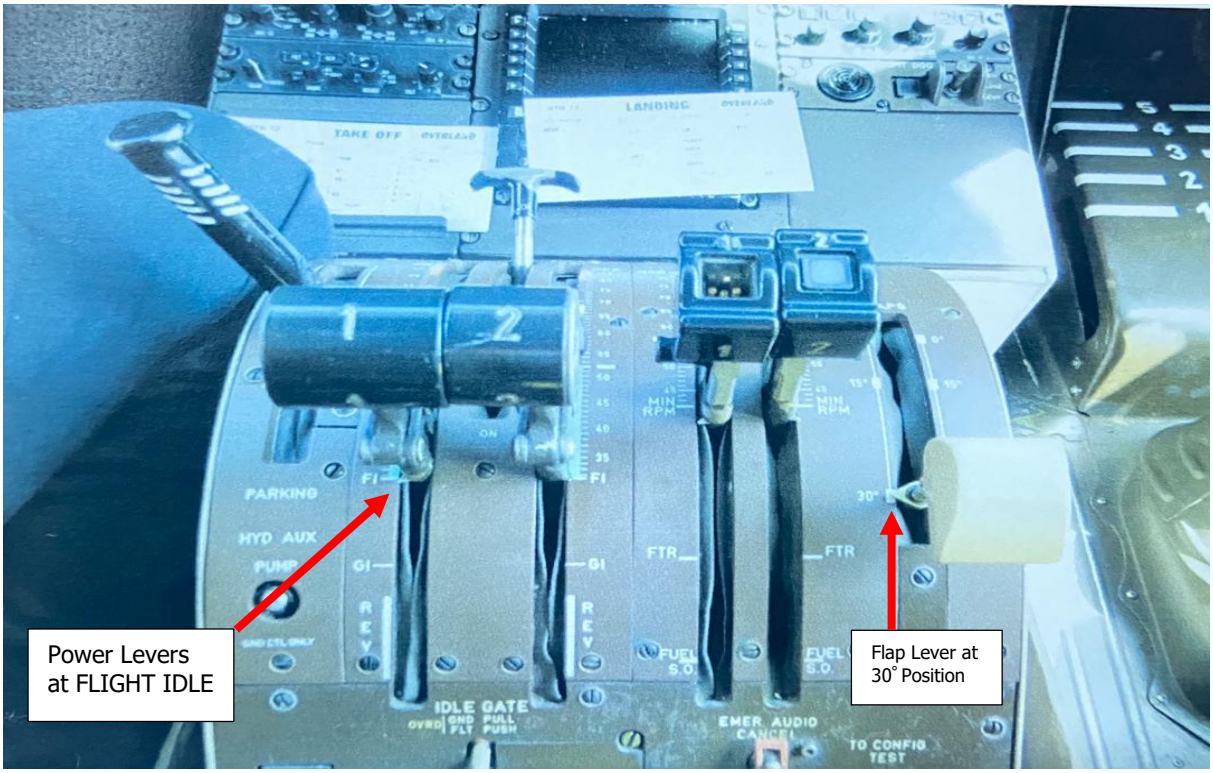

Figure 10: Engine power quadrant

1.13 Medical and pathological information

Nil.

1.14 Fire

There was no pre or post impact fire.

1.15 Survival aspect

After the runway excursion, the Pilot gave a command over the Public Address system (PA) "cabin crew, take position for possible evacuation" the passengers became agitated, standing and shouting. The cabin crew kept emphasizing "remain seated, remain seated". The cabin crew made an assessment of the inside and outside condition. Thereafter, the Pilot announced on PA "cabin crew evacuate! Evacuate using rear doors". The cabin crew opened the left and right aft doors and the evacuation commenced. After the evacuation, the cabin crew took headcount of the passengers and confirmed 59 passengers. The airport authority personnel transferred the passengers to the terminal building. The incident was survivable as the cockpit, cabin, seats and seat restraints were intact.

After the occurrence, all relevant stations were alerted.

1.16 Test and research

Not applicable.

1.17 Organizational and management information

1.17.1 Overland Airways Limited

Overland Airways Limited was incorporated on September 17, 1998 and commenced commercial operations in 2002 with Air Operator Certificate number OAL/AOC/03-14/001. It is an airline registered to operate scheduled and charter flights. Its main base is Murtala Muhammed International Airport, Ikeja, with a hub at Nnamdi Azikiwe International Airport, Abuja. Its routes include; Lagos, Abuja, Ibadan, Ilorin, Akure, Dutse, Minna, Bauchi, Asaba and Jalingo. Overland Airways had a fleet of 9 aircraft comprising of ATR-42, ATR-72 and Beechcraft 1900Ds.

1.18 Additional information

Nil

1.19 Useful or effective investigation technique

Nil

2.0 ANALYSIS

2.1 General

The flight crew were certified and qualified to conduct the flight. The aircraft had a valid Certificate of Airworthiness (C of A) at the time of this occurrence.

The aircraft weight and balance were within prescribed limits. Weather was not considered a factor in this occurrence.

The analysis of this occurrence will focus on the following: conduct of the flight, hydraulic system failure and crew action after landing.

2.2 Conduct of the flight

OLA1186 departed Nnamdi Azikiwe International Airport, Abuja (DNAA) on a scheduled passenger flight for Ilorin International Airport, Ilorin (DNIL) on an Instrument Flight Rule (IFR) flight plan. Seven minutes into the flight, at 7,000 ft climbing, the flight crew noticed that the LO LVL (low Level) light of the Blue Hydraulic System came ON. Although the flight crew reported that the HYD LO LVL checklist items of the ATR 72 QRH were accomplished, the FDR data analysis indicates that the ACW electric motor driven pump of the Blue hydraulic system was not switched OFF, as the LO PRESS indication displayed severally along the flight. The action of switching OFF the ACW electric motor driven pump would inhibit the LO PRESS alert. Therefore, the HYD LO LVL checklist items of the ATR 72 QRH was not accomplished correctly. Thus, there was inappropriate application of the Standard Operating Procedures (SOP).

The aircraft reported 30 NM and requested further descent and straight-in VOR approach

RWY 23. However, OLA1186 was asked to standby due traffic on Finals RWY 05 about 16 NM and then instructed to reduce speed, make an orbit about 20 NM to the field.

The flight crew did not inform the ATC of the hydraulic system malfunction and did not request a priority landing during initial contact with ATC. The flight crew should have considered other systems that are dependent on the hydraulic system which might have degraded as a result of the malfunction. Thus, early notification of the situation by the flight crew would have prompted ATC to provide assistance which might include: separation of the aircraft from other traffic, prioritization of the aircraft for landing and providing any other pertinent information that might be required by the flight crew.

On final approach, the flight crew stated that the LO LVL light of the Green hydraulic system also came ON and thus, they requested to enter holding pattern overhead DNIL to allow them figure out the hydraulic problems and also to accomplish the HYD LO LVL and BOTH HYD SYS LOSS checklist items of the ATR 72 QRH.

Total or complete loss of hydraulic system will also have an impact on approach and landing speeds, cross-wind limits and landing distance required. Landing distances will also be increased should the failure result in degradation of braking capability and loss of ground spoilers.

2.3 Hydraulic system failure

A day prior to the occurrence, the No.1 Brake Unit Assembly was found leaking during a pre-flight inspection of the aircraft and was deactivated in accordance with the ATR 72 Aircraft Maintenance Manual and the approved ATR72 Minimum Equipment List (MEL). The aircraft operated 5 flights with the deactivated No.1 Brake Unit Assembly. However, on the

sixth flight, which was the incident flight, both hydraulic systems of the aircraft reported low level.

At about 7,000 ft during climb, the LO LVL light of the BLUE Hydraulic System came ON, the QRH was consulted but not completed appropriately as the ACW electric motor driven pump of the Blue System was not switched OFF. On final approach, the LO LVL light of the GREEN Hydraulic System also came ON.

The ATR 72 Flight Crew Operating Manual chapter 1.12 hydraulic system states that:

In case of LO LEVEL alert, cross feed valve:

- is inhibited to open

- closes automatically if it was in open position.

In case of low level in the hydraulic fluid quantity from any of the system, the system was designed to prevent cross feeding of the hydraulic fluid from either of the system thereby, preventing complete loss of the hydraulic fluid from the system.

The investigation could not determine the cause of the hydraulic system malfunction.

2.4 Crew action after landing

As established earlier, the aircraft lost both hydraulic systems before landing rendering the normal braking system ineffective. Therefore, only the emergency braking through a specific accumulator to the four brake units was available to the flight crew. When the emergency brake handle is operated, the Antiskid system is inoperative. Also, it is known that the No. 1 Brake Unit was deactivated due to identified leakage. Upon pulling of the emergency brake handle, hydraulic pressure from the accumulator would have been applied equally to all the four main wheel brakes. However, since the No.1 brake unit was

deactivated, the aircraft experienced asymmetric braking with the right main wheels having more braking action than the left main wheels. Hence, the aircraft started to veer right of the runway centerline when the airspeed reduced below 70 kt, and the rudder became ineffective. Therefore, the crew lost directional control of the aircraft and it veered off the runway into the grass verge.

3.0 CONCLUSIONS

3.1 Findings

1. The flight crew were certified and qualified to conduct the flight.
2. The aircraft had a valid Certificate of Airworthiness.
3. The aircraft weight and balance were within prescribed limits.
4. A day prior to the occurrence, the No.1 Brake Unit was found leaking during pre-flight inspection. The affected Brake Unit was deactivated and its rectification was deferred in accordance with chapter 32-42-1 of the approved ATR 72 Minimum Equipment List, which permitted aircraft operations for the next 10 days (Category C).
5. The aircraft operated five sectors after the deactivation of its No.1 Brake Unit.
6. LO LVL light of the Blue Hydraulic System came on shortly after takeoff.
7. The crew consulted the QRH after the Blue Hydraulic System LO LVL light came on.
8. TWR instructed OLA1186 to reduce speed and make an orbit at 20 NM to the field to accommodate the traffic landing on RWY 05.
9. On final approach, the flight crew observed that the LO LVL light of the Green Hydraulic System also came ON and HYD LO LVL and BOTH HYD SYS LOSS. Therefore, the flight crew selected a holding pattern.
10. The aircraft lost both hydraulic systems.
11. The flight crew lost directional control during landing roll.

12. The aircraft veered right of the runway centerline and exited, hit a ridge and the nose gear collapsed.

13. The engines were shut down by pulling the ENG FIRE handles as the condition levers were jammed.

14. The Flap Lever was found at 30˚ position and the flaps extended, the Power Levers were at FLIGHT IDLE position and the Condition Levers were at MIN RPM position.

15. The crew and passengers were evacuated uninjured.

3.2 Causal factor

Loss of directional control on ground due to the aircraft being dispatched with one brake inoperative and Loss of both hydraulic systems in flight.

3.3 Contributory factor

Inappropriate application of the Standard Operating Procedures (SOP) following the display of HYD LO LVL indication of the Blue hydraulic system shortly after takeoff.

4.0 SAFETY RECOMMENDATION

No Safety Recommendation was made.

APPENDICES

Appendix 1: Wheel brake deactivation

Customer : OJ
Type : ATR72
Rev. Date : December 1, 2013

Manual: AMMJIC
Selected effectivity: ALL

JIC 32-42-50 REM 10000 : WHEEL BRAKE DEACTIVATION

WHEEL BRAKE DEACTIVATION

*** ON A/C ALL*

TECHNICAL DATA

ZONING DATA

ZONE : 210
731
741

PREPARATION

WORK	SKILL	MEN	MAN-HOURS
	MECHANIC	01	

ELAPSES TIME

GSE	02 PLUGGING CAP	MS21914-4

PUBLICATIONS

TASK DESCRIPTION

001 PREPARATION

1. MAKE CERTAIN THAT THE PARKING BRAKES IS RE-LEASED
2. MAKE CERTAIN THAT THERE IS NO PRESSURE IN THE BRAKE SYSTEM

002 BRAKE ASSY DEACTIVATION

REF. FIG. :324250-REM-00100
NOTE:BEFORE DISCONNECTING ANY HYDRAULIC PIPING USE PROTECTIVE SAFETY GLASSES AND GLOVES.
MAKE CERTAIN THAT THE WHEEL ROTATES FREELY (BRAKE NOT DRAGGING)
1. DISCONNECT HYDRAULIC PIPE (2) FROM THE BRAKE INLET PORT (1) AND FROM THE UNION (4).

Print Date: January 13, 2015 Local Time

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2. REMOVE HYDRAULIC PIPE (2).
3. USING APPROPIATE CAP, BLANK OFF UNION (4) AND INLET PORT (1).
4. PRESSURIZE GREEN HYDRAULIC SYSTEM.
5. APPLY BRAKE AND MAKE CERTAIN THAT THERE ARE NO LEAKS.

(Ref Fig. 32-42-50 WHEEL BRAKE DEACTIVATION)

32-42-50 WHEEL BRAKE DEACTIVATION

Customer : OJ
Type : ATR72
Rev. Date : December 1, 2013

Manual: AMMJIC
Selected effectivity: ALL

JIC 32-42-50 REM 10000 : WHEEL BRAKE DEACTIVATION

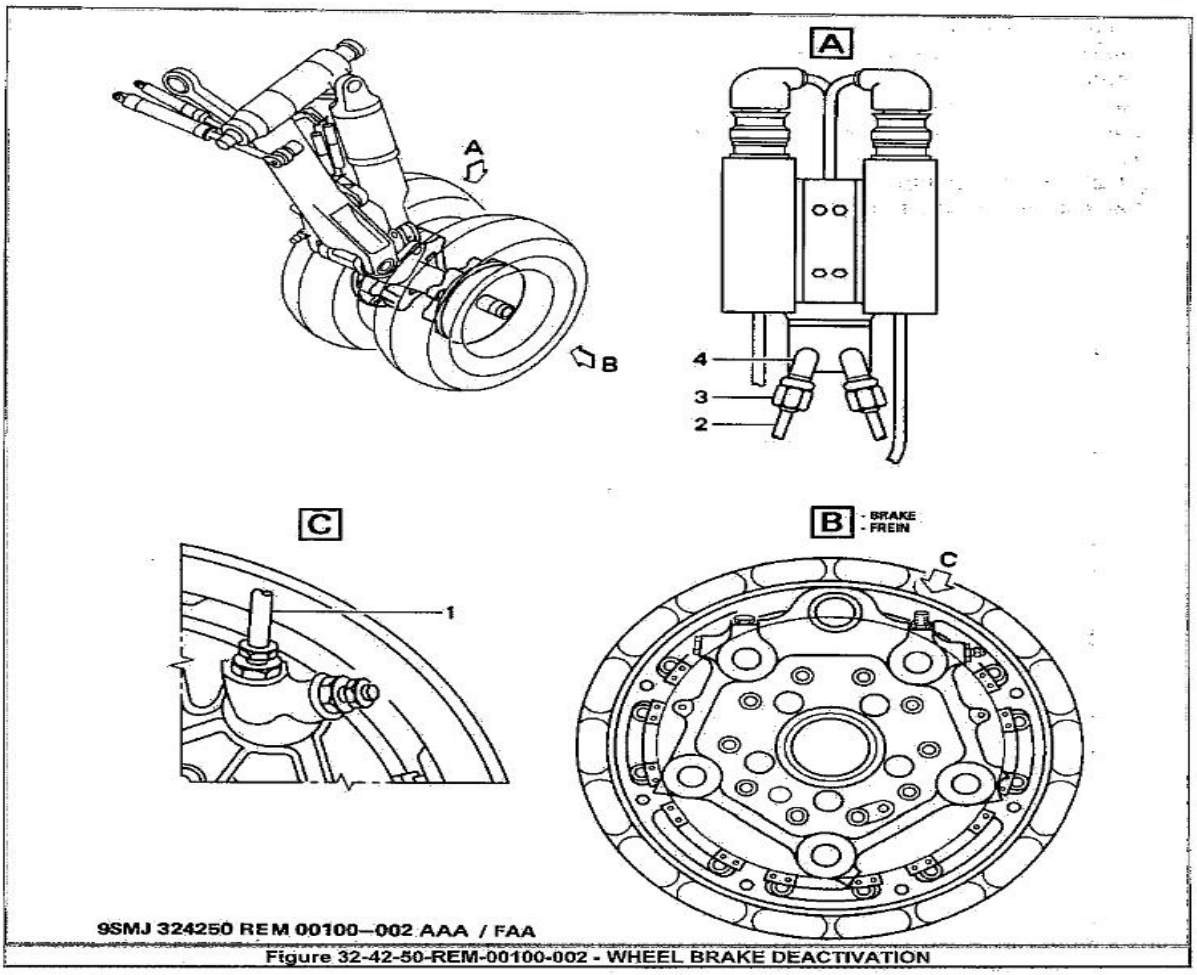

Figure 32-42-50-REM-00100-002 - WHEEL BRAKE DEACTIVATION

Print Date: January 13, 2015 Local Time

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