AIRCRAFT ACCIDENT REPORT

AERO/2017/04/18/F

Accident Investigation Bureau

Report on the Serious Incident involving Bombardier DHC-8-Q400 aircraft owned and operated by Aero Contractors Company of Nigeria Ltd. with nationality and registration marks 5N-BPU which occurred at FL240, 80 NM to Lagos On 18th April 2017

This report is produced by the Accident Investigation Bureau (AIB), Murtala Muhammed Airport, Ikeja, Lagos.

The report is based upon the investigation carried out by Accident Investigation Bureau, 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 2016.

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.

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Accident Investigation Bureau 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 for further distribution, acknowledging the Accident Investigation Bureau as the source.

Safety Recommendations in this report are addressed to the Regulatory Authority of the State (NCAA). This authority ensures enforcement.

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Printed in Nigeria for the Accident Investigation Bureau (AIB)

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GLOSSARY OF ABBREVIATIONS USED IN THIS REPORT

AFM	Aircraft Flight Manual
AGL	Above Ground Level
AIB	Accident Investigation Bureau
AMSL	Above Mean Sea Level
APU	Auxiliary Power Unit
ATC	Air Traffic Control
ATIS	Automatic Terminal Information service
ATPL (A)	Airline Transport Pilot License
BKN	Broken
CARs	Canadian Aviation Regulations
CB	Circuit Breaker
Cb	Cumulonimbus
CPL (A)	Commercial Pilot License (Aeroplane)
CVR	Cockpit Voice Recorder
DNPO	Location identifier for Port Harcourt International Airport
EPR	Engine Pressure Ratio
FAAN	Federal Airports Authority of Nigerian
FCOM	Flight Crew Operations manual

FL	Flight Level
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IMC	Instrument Meteorological Condition
IR	Instrument Ratings
NCAA	Nigerian Civil Aviation Authority
Nig.CARs	Nigeria Civil Aviation Regulations
NiMET	Nigerian Meteorological Agency
PF	Pilot Flying
PIC	Pilot in Command
PM	Pilot Monitoring
POT	Port Harcourt VOR
RWY	Runway
S	Serviceable
SARPs	Standard and Recommended Practices
SOP	Standard Operating Procedures
SSFDR	Solid State Flight Data Recorder
TC	Transport Canada

TSRA	Thunderstorm and Rain
TWR	Tower
US	Unserviceable
UTC	Coordinated Universal Time
V_{APP}	Target Approach Speed
VFR	Visual Flight Rules
VHF	Very High Frequency
VMC	Visual Meteorological Condition
VOR	VHF Omnidirectional Range
V_{REF}	Reference landing speed

Aircraft Accident Report No.:	AERO/2017/04/18/F
Registered owner/Operator:	Aero Contractors Company of Nigeria Ltd.
Manufacturer:	Bombardier
Model:	DHC-8-Q400
Serial Number:	4079
Nationality and Registration Marks:	5N-BPU
Location of Incident:	FL240, 80 NM to Lagos.
Date and Time:	18th April 2017 at 17:50 h *All times in this report are local time (equivalent to UTC+1) unless otherwise stated.*

SYNOPSIS

Accident Investigation Bureau (AIB) was not officially notified of the serious incident but got to know about it through social media on 19th April, 2017. AIB investigators were immediately dispatched to the Aero Contractors' hangar in Lagos, where the aircraft was parked.

On the 18th of April, 2017 at about 17:50 h, a Bombardier DHC-8-Q400 aircraft with registration marks 5N-BPU, operated by Aero Contractors Company of Nigeria Ltd as a scheduled flight NIG316, while cruising at FL240, 80 NM inbound Lagos from Port

Harcourt, experienced bluish smoke which gradually increased in density within the cabin.

The smoke progressed into the cockpit. The lavatory smoke detector aural warning activated, and the AFT BAGGAGE light illuminated on the Fire Panel but there was no burning smell perceived. At 17:55 h the crew donned Oxygen masks and requested clearance to descend. NIG316 was cleared for immediate descent to 2,200 ft AMSL and requested to contact Lagos Approach. The aircraft contacted Lagos Approach requesting fire assistance on the ground.

The crew followed the FUSELAGE FIRE, SMOKE or FUMES in the QRH and executed "SMOKE" (Warning Light) checklist procedure, the aircraft landed safely on runway 18L at about 18:03 h and taxied to Aero Contractors maintenance facility at the General Aviation Terminal (GAT).

The passengers disembarked normally without injuries.

The investigation identified the following causal factor:

Causal Factor

Engine oil leaked onto a hot surface of the engine causing fumes which mixed with the engine bleed air supply to the air conditioning system, resulting in smoke in the aircraft cabin, cockpit and lavatory/ cargo compartments.

Two Safety Recommendations were made.

1.0 FACTUAL INFORMATION

1.1 History of Flight

On the 18th of April, 2017 at 17:00 h, a Bombardier DHC-8-Q400 aircraft with nationality and registration marks 5N-BPU, operated by Aero Contractors Nigeria Ltd as a scheduled flight NIG316, on an Instrument Flight Rule (IFR) Flight Plan, departed Port Harcourt International Airport (DNPO) for Murtala Muhammed International Airport Lagos (DNMM) with 4 crew and 53 passengers on board. The Captain was the Pilot Flying (PF) while the Co-pilot was the Pilot Monitoring (PM).

At about 17:50 h while the aircraft was cruising at FL240, 80 NM to Lagos, the Lead crew informed the cockpit crew about the appearance of smoke in the cabin without smell and which did not irritate the eyes. From the crew account, the Captain briefed passengers "to remain calm all was fine" since there was no smell and caution indication in the cockpit. The lead crew called cockpit about 5 minutes later that smoke was now very visible in the cabin. At this time the forward lavatory smoke detector activated and was heard both in the cockpit and cabin. The smoke began to appear in the cockpit by this time. The cockpit crew immediately followed the DHC8-400 Quick Reference Handbook (QRH) "Fuselage Fire, Smoke or Fumes" Procedures, which included donning their oxygen masks, declaring an emergency with Lagos ATC and activation of Fire extinguishants/Smoke Evacuation.

At 17:55 h, the crew requested for descent due to smoke in the cockpit and cabin. The crew also requested for emergency services assistance on ground. ATC cleared the aircraft for rapid descent to altitude of 2,200 feet and requested crew to contact Lagos Approach. The Captain reported, "during descent we observed the "SMOKE" and "CHECK FIRE DET" warning lights illuminated immediately followed by the "AFT

BAGGAGE" light on the fire panel above". At 18:03 h the aircraft landed safely on RWY 18L, taxied to MMA GAT and parked. All passengers disembarked normally.

On the day of the incident, the aircraft had operated 5 sectors. The incident flight was the sixth sector and the last flight of the day.

The checked-in baggage was off-loaded and inspected for presence of Dangerous Goods, burn or smoke but there was no noticeable sign on any of the baggage.

Visual Meteorological Conditions (VMC) prevailed at the time of occurrence.

This incident occurred in daylight.

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	Nil
None	4	53	57	Not Applicable
Total	4	53	57	Nil

1.3 Damage to Aircraft

There was no damage to the aircraft.

1.4 Other Damage

Nil.

1.5 Personnel Information

1.5.1 The Pilot (Captain)

Nationality:	Nigerian
Age:	46 years
License Type:	Airline Transport Pilot Licence
License Validity:	12th June, 2019
Medical Validity:	11th December, 2017
Proficiency Checks validity:	15th June, 2017
Ratings:	DHC-8-400, B737-300, 400/500
Total Hours:	5,898 h
As PIC:	1,609 h
As PIC on Type	996:55 h
Last 90 Days:	156 h
Last 28 Days:	36 h
Last 24 Hours:	2:10 h

1.5.2 The Co-pilot

Nationality:	Nigerian
Age:	32 years
License Type:	Commercial Pilot Licence
License Validity:	12th August, 2020
Medical Validity:	13th February, 2018
Proficiency Checks validity:	15th June, 2017
Ratings:	DHC-8-400, B737-300, 400, 500
Total Hours:	1,963:34 h
On Type:	1,731:34 h
Last 90 Days:	147 h
Last 28 Days:	40 h
Last 24 Hours:	2:10 h

1.6 Aircraft Information

1.6.1 General Information

Type:	Bombardier DHC-8-Q400
Manufacturer:	Bombardier (De Havilland Canada)
Year of Manufacture:	2003
Serial Number:	4079
Nationality and Registration Marks:	5N-BPU

Registered Owner/Operator:	Aero Contractors Company of Nigeria Ltd.
Certificate of Airworthiness Validity:	5th August, 2017
Certificate of Insurance Validity:	30th June, 2017
Total Airframe Hours:	22,374:49 h
Total flight cycles:	26,248

This Bombardier Dash 8 Q400 (DHC8-400, serial number 4079) is a 78-seat unique turboprop aircraft manufactured by de Havilland Canada (now Bombardier Incorporation) in 2003. It is a series of twin-engine, medium-range, turboprop airliner. It is powered by two PW150A engines manufactured by Pratt & Whitney Canada. Mounted on each engine is a six-bladed propeller assembly manufactured by Dowty Propellers.

Figure 1: Photo of Aero Contractors Bombardier DHC-8-Q400 aircraft

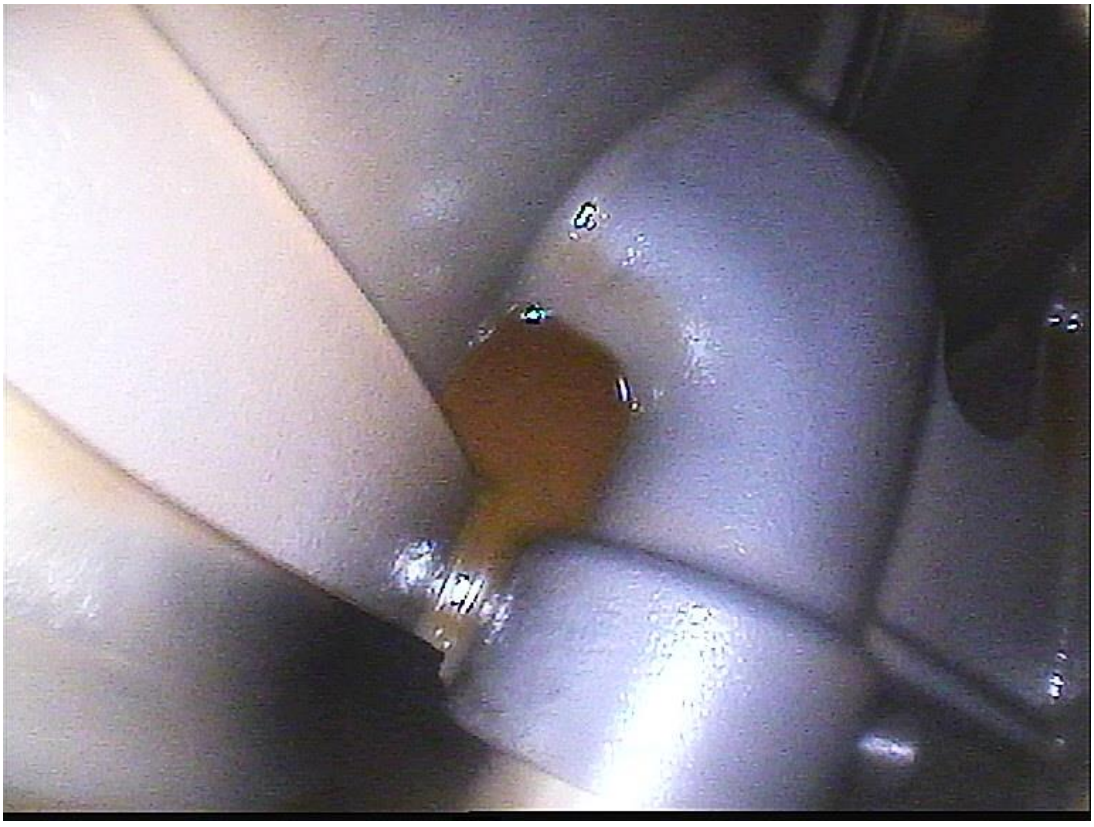

Figure 2: Photo of a pool of oil inside engine No. 1 discovered during borescope inspection

1.6.2 Engines

No.1

Type:	PW 150A
Manufacture:	Pratt & Whitney Canada
Serial Number:	PCE-FA0171
Date of Manufacture:	2002
Time Since New:	21,179:20 h

1.6.3 Propellers

No. 1

Type:	R408/6-123-F/17
Serial Number:	DAP0388
Manufacturer:	Dowty Propellers
Date of Manufacture:	2007
Time Since New:	4940:26 h

1.7 Meteorological Information

Source:	**LAG ATIS**
Wind direction/ Speed:	210/07 kt
Visibility:	10 km, Clear
Weather:	Nil
Cloud:	SCT1300
Temperature/ Dew point:	31°C/25°C
QNH:	1008 hPa

1.8 Aids to Navigation

The Instrument Landing System (ILS) and Very High Frequency Omnidirectional-Radio Range/Distance Measuring Equipment (VOR/DME) at DNMM were serviceable at the time of the occurrence.

1.9 Communications

There was good two-way communication between the aircraft and ATC. There was limited communication between the cabin crew and the cockpit crew when the incident was reported. The cockpit crew action on decompression of the cabin was not communicated to the cabin crew.

1.10 Aerodrome Information

The MMA has two parallel bi-directional runways - RWY 18L/36R, 9,006ft (2,745m) and 18R/36L, 12,795 ft (3,900 m). It is located on an Elevation of 135 ft AMSL with a Coordinate of 06° 34′ 43″ N, 03° 19′ 12″ E.

There are two ILS/DME and one VOR in DNMM. The VOR is aligned with the centreline of the RWY 18L (113.7MHz LAG). The two ILS/DME are installed on RWY 18L (110.3MHz ILA) and 18R (108.1MHz ILB) respectively. The runway surfaces are asphalt coated.

1.11 Flight Recorders

The flight recorders were not retrieved for download.

1.12 Wreckage and Impact information

Not Applicable.

1.13 Medical and Pathological information

Not Applicable.

1.14 Fire

There was no fire reported during and after the incident.

1.15 Survival Aspects

This incident was survivable as occupants did not complain of any choking or irritation from the smoke. Emergency services were alerted and positioned prior to the aircraft arrival. The passengers disembarked normally and there were no reported injuries.

1.16 Test and Research

Aero Contractors maintenance engineers carried out trouble shooting procedures for Smoke in the Cabin, which included tests on the aircraft electrical system, which was found satisfactory. However, the oil quantity in engine No. 1 oil tank was observed to be low. Inspection of magnetic chip detector showed no sign or evidence of any metallic debris or particles.

Thereafter, engine ground run was performed with Bleed switch ON which led to the re-appearance of the smoke in the cabin.

Following the occurrence, Aero Contractors notified the airframe manufacturer (Bombardier) and the engine manufacturer (Pratt & Whitney Canada). The manufacturers advised that a Borescope Inspection be carried out on the affected engine (No.1 engine, serial number PCE-FA0171).

Aero Contractors carried out the Borescope Inspection on No.1 Engine in accordance with Aircraft Maintenance Manual (AMM) 79-00-810-807 and 05-50-24**. (See Appendix B)**

The Inspection revealed the following:

1. A collection of oil seen in the Compressor Inner Support (CIS) section of the engine
2. Visible oil stains and wetness at different sections in the gas path: inner compressor, Low Pressure 1st Stage Compressor Blades, High Pressure 4th Stage Axial Compressor, Inter Turbine Vanes, Accessory Gearbox and Inter Compressor Case.
3. Traces or random light oil stains were found on the blades and vanes in all other sections of the engine.

However, the engine was never sent to P&WC for tear down and investigation analysis to confirm these observations.

1.17 Organizational and Management Information

1.17.1 Aero Contractors Company of Nigeria Limited

Aero Contractors Company of Nigeria Limited is a registered Airline Operator engaged in Scheduled and Charter Air Transportation using both fixed wing and rotary wing

Aircraft. Its fixed wing operational base is located at General Aviation Terminal (G.A.T), Ikeja, Lagos, while the rotary wing operational base is located at Nigerian Airforce Base in Port Harcourt.

The Operator is also a holder of Nigerian Approved Maintenance Organisation (AMO) certificate with limited ratings in all aircraft in its fleet. It has the capability of up to C Check level on DHC8-400 aircraft. Bombardier DHC-8-Q400 aircraft are maintained in Nigeria by qualified Aircraft Maintenance Engineers employed by Aero Contractors inside its hangar facility. However, major checks are carried out by SAMCO AIRCRAFT MAINTENANCE at MAASTRICHT, the Netherlands.

1.17.2 Nigerian Civil Aviation Authority (NCAA)

The Nigerian Civil Aviation Authority (NCAA) is the apex body responsible for the regulations and oversight of the activities of civil aviation in Nigeria. NCAA issues authorizations, licenses, approvals, permits and certificates on personnel, airline operators, air navigation services providers, aerodrome operators, and other service providers in the aviation sector. It exercises its privileges, among other means, by carrying out inspections and audits based on the instrumentality of the Civil Aviation Act of 2006 and the Nigerian Civil Aviation Regulations.

1.18 Additional Information

1.18.1 Pratt & Whitney Canada Oil Analysis Technology

HOW OIL ANALYSIS TECHNOLOGY WORKS

Based on trace particles found in oil samples, Oil Analysis Technology compares an engine's current condition to the baseline profile or "signature" of a healthy engine, making it possible to identify component-specific deterioration patterns. If the analysis shows that maintenance should be done, appropriate actions will then be recommended.

Each engine model has a different healthy signature, which needs to be established before it is ready for application of the technology. P&WC is currently working on developing signatures for each engine it manufactures through an ***Oil Analysis Technology*** trial being conducted with the help of operators around the world, who send in samples for analysis.

To date, the team has received over 12,000 samples, enabling it to establish the healthy signature for PW306A, PW617, PT6A-62, PT6A-67B and PT6A-67P engines. Once sufficient data has been collected, the aim is to roll out the technology to all models.

Preventive Safety Action: To mitigate the risk for operators that have not yet complied with SB 35342R1 (Modification of bearing carbon seal P/N 3071831-01), Pratt & Whitney Canada has developed a new oil analysis technology to detect chemical elements and alloys in the engine oil, and to analyse its concentration and particulate characteristics to determine the source (component) of the material.

P&WC reports that the technology provides improved precision and sensitivity compared to that of traditional oil debris analysis technology used to monitor the health of oil-

wetted engine components such as Bearings, Carbon Bearing Seals, and Gears. The company has also reported successful detection and identification of material generated by deteriorating 2.5 bearing carbon Seal in a PW150A engine 900 hours before the Seal required replacement to prevent oil contamination of the compressor and cabin air.

The oil analysis programme which has been available to operators on a trial basis since 2016 is currently available to all operators.

1.19 Useful or Effective Investigation Techniques

Nil.

2.0 ANALYSIS

2.1 Borescope Inspection on Engine No. 1

Borescope Inspection on Engine No. 1 showed traces of oil around the Low Pressure Compressor stage 1 blades, Inter-Compressor-Case (ICC), Inter-Turbine Vane Struts and Gas generator area of the engine. Wetness was found at the Gas Generator Case, PT Stage 1 case and Low Pressure Turbine (LPT) blades. The bleed air for the air conditioning system is extracted from stage 5 or 9 of the compressor (as the case may be) through a bleed valve and mixes with hot air for the required temperature to achieve passenger comfort. The presence of smoke in the cabin and cockpit area can be attributed to this conditioned air.

The result of the Borescope inspection carried out by the Aero Contractors Company Ltd revealed that the source of oil leakage from No.1 engine could not be ascertained at the conclusion of the borescope inspection but the oil found in the shaft area of the compressor interchange CIS was suggestive of failure of either CIS carbon seal or any of the internal oil supply tubes. The pool of oil leak mixing with the engine bleed air resulted to smoke in the aircraft cabin, cockpit and lavatory/cargo compartments which contaminated the Air Conditioning system of the aircraft. The smoke had no smell or odour, was not irritating to the eyes and did not cause cough.

Considering a significant number of previous occurrences of smoke in the cabin was traced to oil leaks from the CIS Bearing Carbon Seals in DCH8-400, Pratt & Whitney Canada, being the manufacturer of the engine (PW150A), had designed upgraded Bearing Carbon Seal and recommended its installation via Service Bulletin 35342R1. Furthermore, P&WC had developed a new oil analysis technology programme for the detection of impending seal failures and made it available to all operators whose engines were yet to comply with SB 35342R1.

The investigation revealed that this Service Bulletin was issued after this occurrence.

2.2 Emergency Procedures and landing

The crew have conducted the flight appropriately in accordance with the company procedures stipulated in Quick Reference Handbook (**APPENDIX A: QRH Procedures)** and landed the aircraft safely with no damage or injuries. It was reported that the flight deck crew did not communicate effectively with the cabin crew and hence, there was poor coordination between the cockpit crew and the cabin crew throughout the duration of the emergency procedures.

3.0 CONCLUSION

3.1 Findings

1. The communication between the cabin crew and the cockpit crew at the time of incident was inadequate.
2. The crew were qualified and certified to operate the flight.
3. The occurrence flight was the sixth flight of the day for the crew.
4. The checked-in baggage was off-loaded and inspected for presence of Dangerous Goods, burns or smoke but there was no noticeable sign on any of the baggage.
5. Records showed that the aircraft was certified, equipped and maintained in accordance with the current regulations and approved procedures at the time of occurrence.
6. Borescope inspection on No.1 engine showed visible oil stains and wetness at different sections in the gas path: inner compressor, LP 1st compressor blades, HP 4th stage axial compressor, inter turbine vanes, accessory gear box and inter compressor case.
7. Oil filter was checked but no contamination was found.
8. Magnetic chip detector was found clean and free of metal particles
9. Low oil level was observed in No. 1 engine oil tank.
10. P&WC had issued SB 35342 since 2016 to modify carbon seals installed on PW150A engines. SB (35342R1) was revised in 2018.

11. P&WC had developed a new oil analysis technology programme and made it available to all operators to utilize on engines that are yet to comply with SB 35342R1 to detect impending failure of the carbon seals long before it actually fails.

12. On the day of the incident, the aircraft operated 5 sectors. The incident flight was the sixth sector and the last flight of the day.

13. The affected engine (Serial Number PCE-FA0171) was not shipped to Pratt & Whitney Canada (P&WC) for a tear down and inspection at the time of this investigation.

3.2 Causal Factor

Engine oil leaked onto a hot surface of the engine causing fumes which mixed with the engine bleed air supply to the air conditioning system, resulting in smoke in the aircraft cabin, cockpit and lavatory/ cargo compartments.

4.0 SAFETY RECOMMENDATIONS

4.1 Safety Recommendation 2019-024

Aero Contractors Company of Nigeria Limited should ensure that Cockpit and Cabin Crew are alive to their responsibilities during emergencies vis-à-vis establishing effective two-way communication.

4.2 Safety Recommendation 2019-025

Nigerian Civil Aviation Authority should ensure that operators utilize the New Oil Analysis Technology made available by Pratt & Whitney Canada in order to identify impending failure of the carbon seals on PW150A engines that are yet to comply with SB 35342R1.

APPENDICES

Appendix A: QRH Procedures

FUSELAGE FIRE, SMOKE or FUMES

"SMOKE" (Warning Light)

(SMOKE Warning Light and related Baggage / Cargo SMOKE and EXTG Advisory Lights)

OR

FUSELAGE FIRE, SMOKE or FUMES

- Oxygen Masks ..... on / 100%
- Smoke Goggles (if applicable) ..... on
- Mic Switch ..... Mask
- Recirc Fan ..... Off

– Prepare to land the aircraft without delay while completing fire suppression and/or smoke or fumes evacuation procedures.

Known Source of Fire, Smoke or Fumes:

Flight Compartment:

Note: *If an electrical source of fire, smoke or fumes is positively identified, remove power to source if possible.*

– Extinguish fire with portable fire extinguishers.

– If it cannot be visibly verified that the fire has been extinguished following fire suppression, land immediately at the nearest suitable airport.

To remove smoke or fumes:

- Cabin Alt Fwd Outflow ..... turn clockwise towards Opn

Note: *Flight compartment airflow will carry the smoke or fumes forward.*

IF additional assistance to remove smoke or fumes is required:

Note: *This step will de-pressurize the aircraft rapidly.*

- Fwd Outflow Valve ..... Open

– Descend to below 14,000 ft as soon as possible.

– END –

CONTINUED ON NEXT PAGE

Cabin:

- Emergency Lights ..... if req'd
- Evacuate passengers from affected area.
- Extinguish fire with portable fire extinguishers.

Note: *If a pilot is required to fight the fire, protective breathing equipment must be donned prior to exiting the flight compartment.*

- If it cannot be visibly verified that the fire has been extinguished following fire suppression, land immediately at the nearest suitable airport.

IF assistance to remove smoke or fumes from the cabin is required:

Note: *This step will de-pressurize the aircraft rapidly.*

- Auto / Man / Dump ..... Dump
- Descend to below 14,000 ft as soon as possible.

– END –

Baggage / Cargo Compartment:

- Illuminated SMOKE / EXTG switch ..... press

Note: *The second Baggage compartment FIRE BOTTLE LOW Advisory Light may illuminate after the first bottle has been discharged.*

- Land immediately at the nearest suitable airport.

– END –

Unknown Source of Fire, Smoke or Fumes:

Note: *To prepare for and manage an immediate landing, the Unknown Source of Fire, Smoke or Fumes procedure may be terminated prior to completion.*

Bleed Source or Air Conditioning Suspected:

- Bleed Air 1 ..... Off

Wait up to 1 minute.

Improvement:

Yes

- Leave Bleed Air 1 in the Off position.

IF necessary to assist in removal of smoke or fumes:

- SMOKE or FUMES REMOVAL (Page 7.6) ..... accomplish

– END –

No

CONTINUED ON NEXT PAGE

Unknown Source of Fire, Smoke or Fumes
Bleed Source or Air Conditioning Suspected (cont'd):

No

- Bleed Air 1 ..... on
- Bleed Air 2 ..... Off

Wait up to 1 minute.

Improvement:

Yes

- Leave Bleed Air 2 in the Off position.

IF necessary to assist in removal of smoke or fumes:

- SMOKE or FUMES REMOVAL (Page 7.6) ..... accomplish

– END –

No

- Bleed Air 2 ..... on
- Flt Comp Pack ..... Off

Wait up to 1 minute.

Improvement:

Yes

- Leave Flt Comp Pack in the Off position.

IF necessary to assist in removal of smoke or fumes:

- SMOKE or FUMES REMOVAL (Page 7.6) ..... accomplish

– END –

No

- Flt Comp Pack ..... Auto / Man
- Cabin Pack ..... Off

Wait up to 1 minute.

Improvement:

Yes

- Leave Cabin Pack in the Off position.

IF necessary to assist in removal of smoke or fumes:

- SMOKE or FUMES REMOVAL (Page 7.6) ..... accomplish

– END –

No

- Cabin Pack ..... Auto / Man

CONTINUED ON NEXT PAGE

Source of Fire, Smoke or Fumes cannot be Identified:

- DC Gen 1 and 2 ..... Off
- AC Gen 1 and 2 ..... Off
- Storm/Dome Lights ..... Storm (if req'd)
- Main, Aux and Stby Batteries ..... Off
- Emergency Lights ..... Off (until req'd)

– Land immediately at the nearest suitable airport.

Caution: *Battery duration for operation of essential services is 60 minutes (45 minutes JAA).*

Note: *Engine bleed air flow to ECS packs is lost. The aircraft will de-pressurize.*

IF necessary to remove smoke or fumes from the flight compartment:

Note: *This procedure will de-pressurize the aircraft rapidly.*

- Auto / Man / Dump ..... Man
- Man Diff ..... Incr (50 sec)
- Cabin Alt Fwd Outflow .... fully clockwise (Opn)
- Fwd Outflow Valve ..... Open

Note: *Ram ventilation is most effective above 150 KIAS.*

– Descend to below 14,000 ft as soon as possible.

---------- **END** ----------

SMOKE or FUMES REMOVAL (UNKNOWN SOURCE)

– If it cannot be visibly verified that the fire has been extinguished following fire suppression, land immediately at nearest suitable airport.

Note: *Carry out this procedure only when directed by the Unknown Source of Fire, Smoke or Fumes checklist.*

- Recirc Fan ..... Off
- Bleed Air (unaffected) ..... on / Max

Note: *Leave affected Bleed or affected Pack switches in the Off position.*

IF necessary to remove smoke or fumes from the flight compartment:

- Cabin Alt Fwd Outflow ..... turn clockwise towards Opn

IF additional assistance to remove smoke or fumes is required:

Note: *This step will de-pressurize the aircraft rapidly.*

- Fwd Outflow Valve ..... Open

– Descend to below 14,000 ft as soon as possible.

Appendix B: Borescope inspection of No. 1 engine

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Borescope Inspection Report

aero contractors nigeria ltd.
Fixed Wing Division

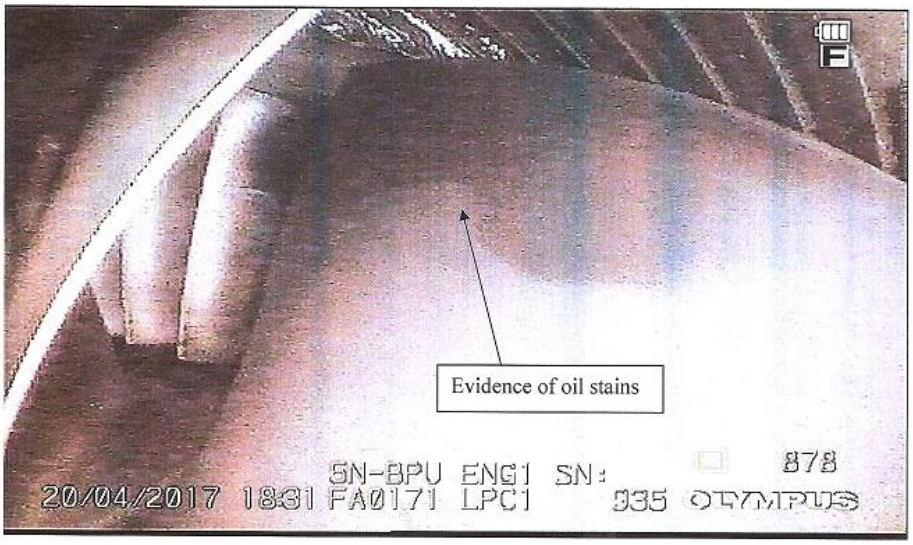
Eng Model:	PW150A	**Report No:**	5N-BPU/000757
Eng S/N:	FA0171	**Manual Reference:**	72-00-00
Date :	20.04.17	**Reason for Inspection:**	SMOKE IN CABIN
Total Hours:	2,178:25	**Total Cycles:**	25,183
A/C Type:	DHC8-Q400	**A/C Reg:**	5N-BPU
Position	#1	**Location**	Lagos

PROPELLER BLADES

Location	Ea	Findings:
		NOT INSPECTED.
In accordance with: 72-00-00		Sign & Stamp:

LPC STAGE 1 BLADES

Location	Ea	Findings:
		Evidence of oil stains found on several blades.
In Accordance with: 72-00-00		Sign & Stamp:



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Borescope Inspection Report

aero contractors nigeria ltd.
Fixed Wing Division

LPC STAGE 2 BLADES

Location	Ea	Findings:
		No visible discrepancy.

In Accordance with:	72-00-00	Sign & Stamp:	

LPC STAGE 3 BLADES

Location	Ea	Findings:
		No visible discrepancy.

In Accordance with:	72-00-00	Sign & Stamp:	

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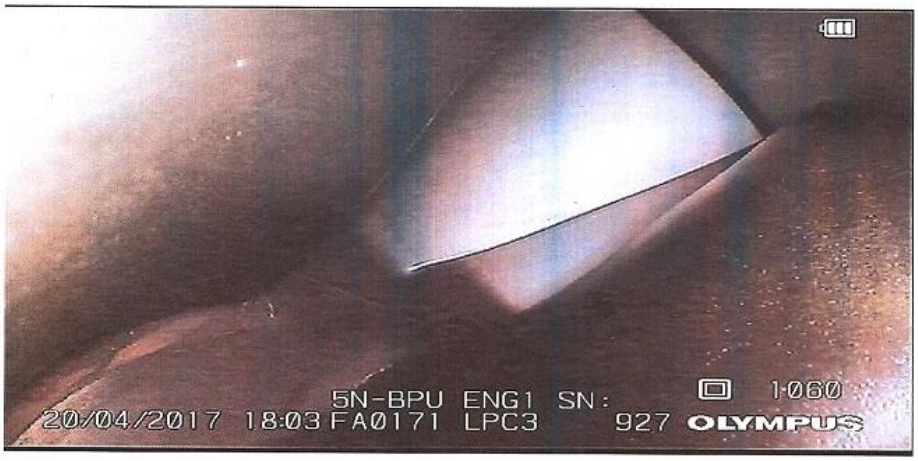
Borescope Inspection Report

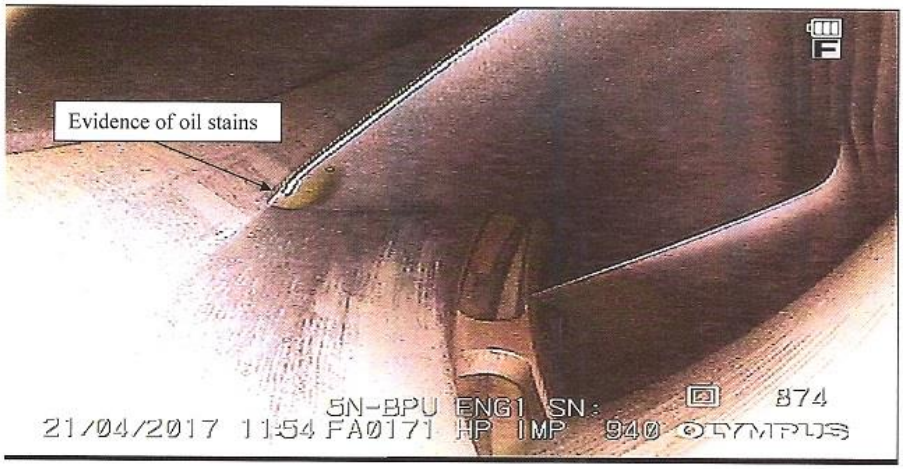
aero contractors nigeria ltd.
Fixed Wing Division



HP IMPELLER

Location	Ea	Findings:
		Evidence of oil stains

In Accordance with:	72-00-00	Sign & Stamp:	



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Borescope Inspection Report

aero contractors nigeria ltd.
Fixed Wing Division

INTER COMPRESSOR CASE

Location	Ea	Findings:
		- Evidence of oil splashes in areas between the accessory gear box and inter compressor case. - Evidence of oil seepage in areas between the accessory gear box and the inter compressor case.

In Accordance with:	72-00-00	Sign & Stamp:	

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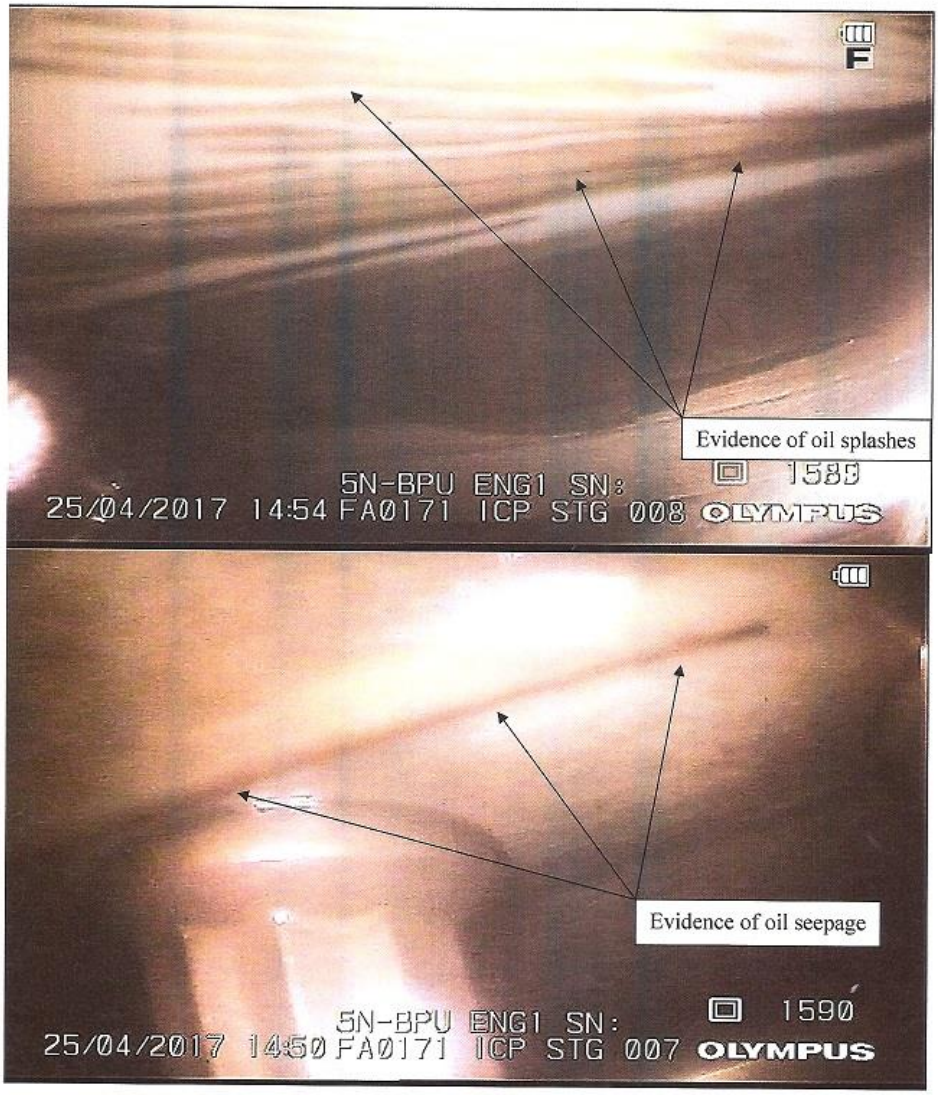
Fixed Wing Division



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Borescope Inspection Report

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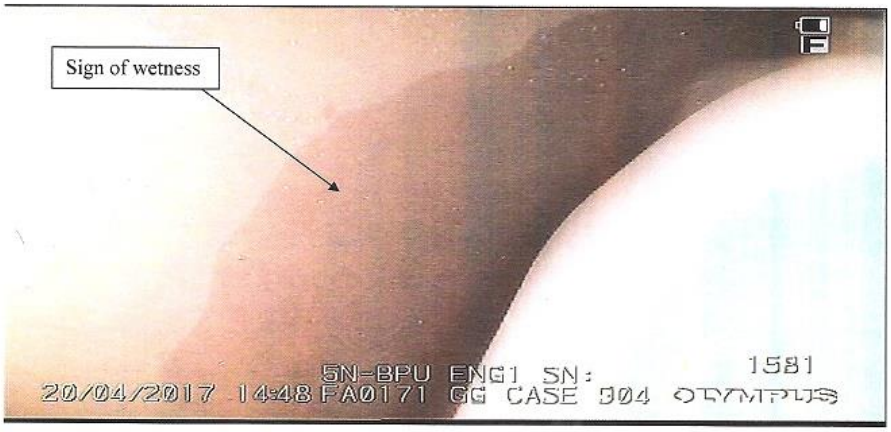
Fixed Wing Division

GAS GENERATOR CASE

Location	Ea	Findings:
		Sign of wetness

In Accordance with:	72-00-00	Sign & Stamp:	



HPT VANES

Location	Ea	Findings:
		NOT INSPECED.

In Accordance with:	72-00-00	Sign & Stamp:	

COMBUSTION CHAMBER

Location	Ea	Findings:
		NOT INSPECED.

In Accordance with:	72-00-00	Sign & Stamp:	

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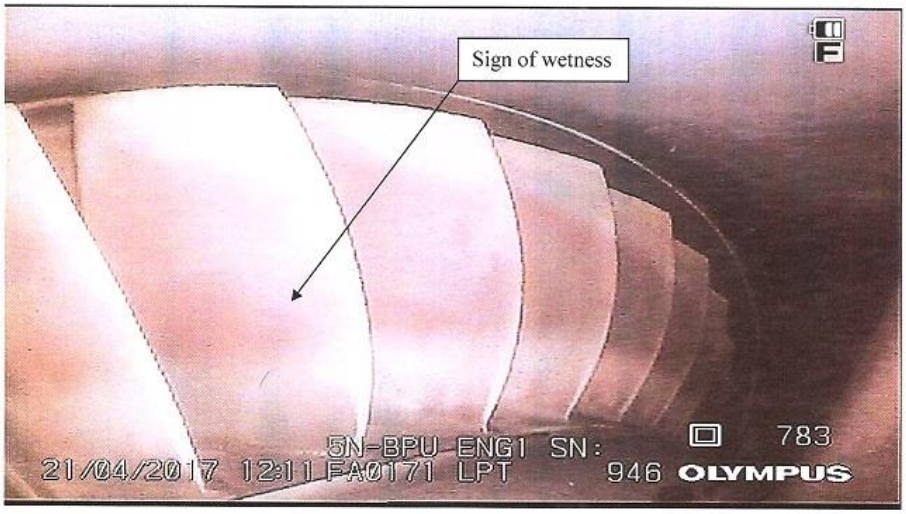
Fixed Wing Division

HPT BLADES

Location	Ea	Findings:
		NOT INSPECED.
In Accordance with: 72-00-00		Sign & Stamp:

LPT BLADES

Location	Ea	Findings:
		Sign of wetness
In Accordance with: 72-00-00		Sign & Stamp:



INTER TURBINE VANE STRUTS

Location	Ea	Findings:
		Evidence of oil stains
In Accordance with: 72-00-00		Sign & Stamp:

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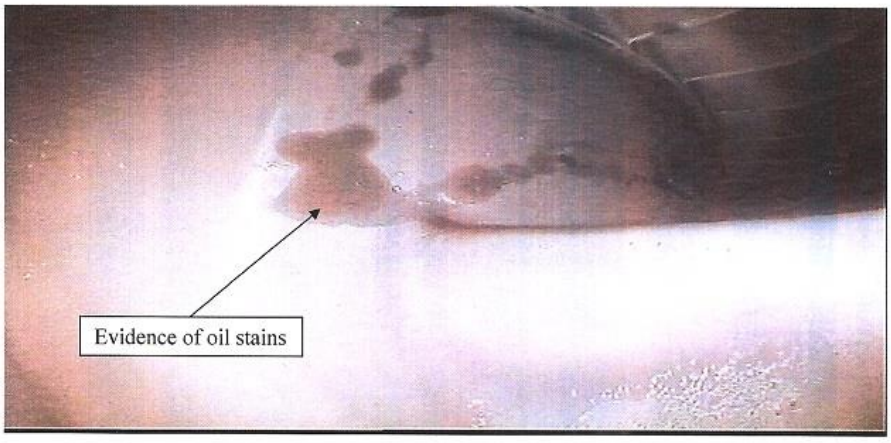
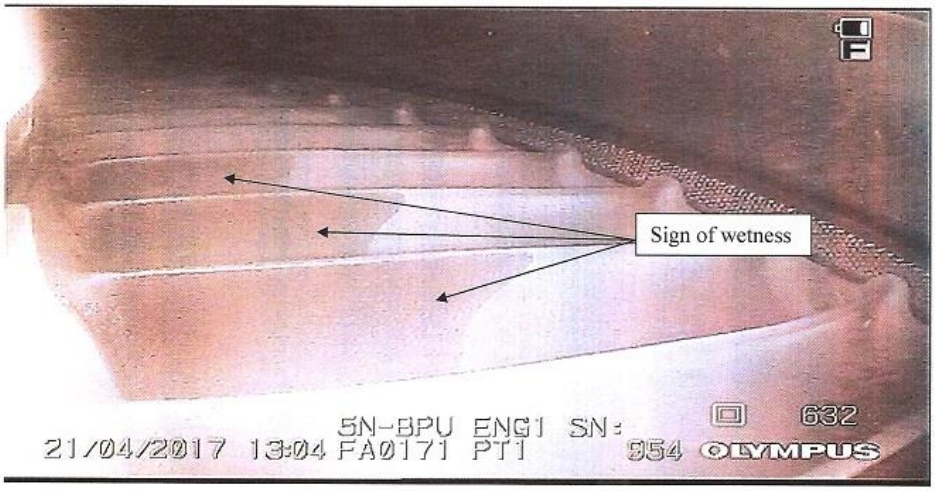
Fixed Wing Division



PT STAGE 1 BLADES

Location	Ea	Findings:
		Sign of wetness

In Accordance with:	72-00-00	Sign & Stamp:	



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Fixed Wing Division

PT STAGE 2 BLADES

Location	Ea	Findings:
		NOT INSPECED.

In Accordance with:	72-00-00	Sign & Stamp:	

Date: 20.04.17		Sign & Stamp: ACN12-2867

The videos and pictures of the inspection are uploaded into Aero W Drive W:\Engine_Boroscope_Videos\DASH8 Q400\ESN FA0171\20.04.17 and W:\Engine_Boroscope_Videos\DASH8 Q400\ESN FA0171\25.04.17

Station Date Stamp