



**FINAL REPORT
AIC 15-1001**

**PAPUA NEW GUINEA
ACCIDENT INVESTIGATION COMMISSION
AIRCRAFT ACCIDENT REPORT**

**Helifix Ltd
P2-HFZ
Bell 206
Bobcat Rig Site
Gulf Province
PAPUA NEW GUINEA
15 February 2015**

The Papua New Guinea Accident Investigation Commission (AIC) was informed of the accident by the operator, Helifix Ltd on 15 February 2015 and commenced an on-site investigation.

This Report, made publicly available on 3 August 2015 was produced by the AIC, PO Box 1709, Boroko 111 National Capital District, Papua New Guinea.

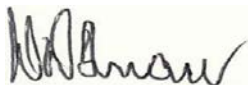
The report is based upon the investigation carried out by the AIC, in accordance with Annex 13 to the Convention on International Civil Aviation, Papua New Guinea (PNG) Act, and Civil Aviation Rules. New Guinea (PNG) Civil Aviation Act 2000 (As Amended), Civil Aviation Rules, and the Commissions of Inquiry Act 1951. It contains factual information, analysis of that information, findings and safety action taken to address identified deficiencies.

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David Inau

Chief Executive Officer

Accident Investigation Commission

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FIGURES

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Figure 3: Damage to generator shed roof

Figure 4: P2-HFZ impact site from rear of aircraft

Figure 5: P2-HFZ impact site from rear of aircraft

Figure 6: Disassembled Pc filter

Figure 7: 'Foreign object' against a ruler in millimetres.

Figure 8: 'Foreign object' against a ruler in millimetres.

TABLES

Table 1: Injuries to persons

INTRODUCTION

SYNOPSIS

On 15 February 2015, the pilot of a Bell 206 Long Ranger helicopter was conducting sling load operations involving moving fuel drums and an electric generator a distance of 150 metres. During a sling load release under the direction of a ground-based load master, the helicopter's engine failed. The investigation found that a small ball of non-ferrous material used in pressure blasting for cleaning/polishing during engine overhaul had become lodged in the orifice of the Pc diffuser union, effectively blocking the Pc air line.

The investigation was unable to determine when or how the ball had entered the Pc line. It is likely that the non-ferrous ball entered the Pc diffuser union during the last engine overhaul.

The blocked Pc fuel line starved the engine of fuel at a critical time of the flight.

The AIC issued recommendations to the Civil Aviation Safety Authority of PNG, the operator Helifix Ltd, and the engine overhaul company Gas Turbine Overhaul Pty Ltd, to address safety issues noted during the investigation.

1 FACTUAL INFORMATION

1.1 History of the flight

On 15 February 2015, the pilot of a Bell 206 Long Ranger helicopter, registered P2-HFZ, owned and operated by Helifix Ltd., was tasked to reposition four 200 L diesel fuel drums and a five kVA generator from the Bobcat Rig floor, Gulf Province, to the generator shed area, a distance of approximately 150 metres.

At 00:00 UTC¹, the pilot started the helicopter and hover taxied it to Bobcat Rig floor with a 50 foot line attached to commence slinging operations. After repositioning the fuel drums, the pilot flew back to Bobcat Rig floor to pick up the generator.

The pickup was normal, with the helicopter's engine performing normally. The generator repositioning flight to the drop-off point was uneventful. As the load approached a position over the drop-off point, the load master on the ground signalled for it to be lowered to the ground. After the load was on the ground, the load master signalled for the pilot to lower the helicopter to release the tension on the line to allow the load master to unhook the sling.

Google earth images modified by the PNG AIC

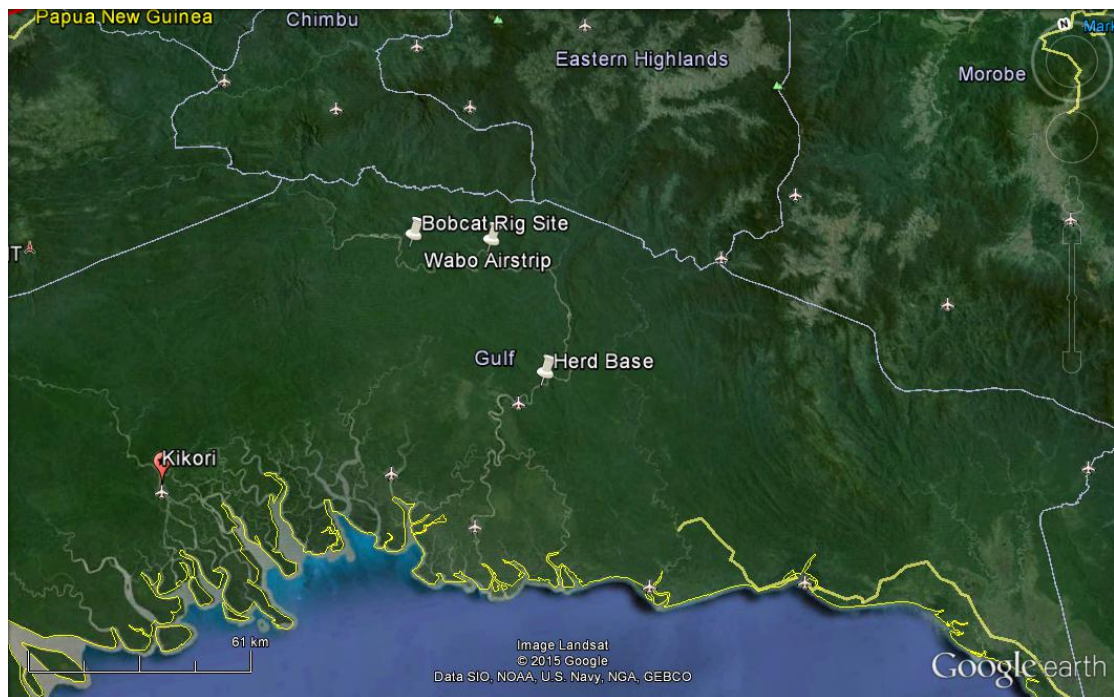


Figure 1: Area of the accident

As the pilot lowered the helicopter there was a sudden loss of power and the helicopter yawed left. He initiated an autorotation and the helicopter landed heavily, striking the generator and sustaining substantial damage to both of its landing-gear skids, the main rotor blades, and the tail boom.

¹ The 24-hour clock is used in this report to describe the local time of day, Local Mean Time (LMT), as particular events occurred. Local Mean Time was Coordinated Universal Time (UTC) + 10 hours.

The pilot was assisted from the helicopter and evacuated to Port Moresby for medical treatment.

1.2 Injuries to persons

The pilot was a Papua New Guinea citizen.

Table 2: Injuries to persons

Injuries	Flight crew	Passengers	Total in Aircraft	Others
Fatal	-	-	-	-
Serious	1	-	-	-
Minor	-	Nil	1	Not applicable
Nil Injuries	-	-	-	Not applicable
TOTAL	1	Nil	1	-

1.3 Damage to aircraft

The helicopter was substantially damaged due to the heavy landing, coming into contact with uneven ground and the generator that had just been airlifted by sling, and the hut housing the camp generator.



Figure 2: P2-HFZ impact site next to the generator

1.4 Other damage

Sheets of roofing iron from the hut housing the camp generator were dislodged from the roof when struck by the main rotor blades during the descent. There was no other damage to property and/or the environment.



Figure 3: Damage to generator shed roof

1.5 Personnel information

1.5.1 Pilot in command

Age	: 58 years
Date of birth	: 12 December 1957
Gender	: male
Nationality	: Papua New Guinea
Type of licence	: PNG CPL(H)
Licence number	: P20281
Valid to	: perpetual
Rating	: Bell 206
Total flying time	: 12,658.50 hours
Total on this type	: 9,269.80 hours
Total last 90 days	: 33.40 hours
Total on type last 90 days	: 33.40 hours
Total last 7 days	: 21.80 hours

Total on type last 7 days	:	21.80 hours
Total last 24 hours	:	5.00 hours
Total on the type last 24 hours	:	5.00 hours
Last recurrent training	:	25 October 2014
Last proficiency check	:	26 March 2014
Last line check	:	26 March 2014
Route recency check	:	26 March 2014
Medical class	:	one
Valid to	:	18 April 2015
Medical limitation	:	Nil

1.6 Aircraft information

1.6.1 Aircraft data

Aircraft manufacturer	:	Bell Helicopter
Model	:	206L4
Serial number	:	52106
Year of manufacture	:	1994
Nationality and registration mark	:	Papua New Guinea P2-HFZ
Name of the owner	:	Helifix Limited
Name of the operator	:	Helifix Limited
Certificate of Airworthiness	:	52106, issued on 5 January 2009
Valid to	:	non-terminating
Certificate of Registration	:	52106, issued on 5 January 2009
Valid to	:	non-terminating
Total time in service	:	9,969.1 hours
Total cycles since new	:	11,376 cycles
Total hours since rebuild	:	324.05 hours
Total cycles since rebuild	:	310 cycles
Last 100/300 hour inspection	:	3 February 2015
Total hours since last Inspection	:	32.7 hours
Total cycles since last Inspection	:	27 cycles

1.6.2 Engine data

Engine Type	: Turboshaft
Manufacturer	: Rolls-Royce
Type	: 250-C30P
Serial number	: CAE-890502
Total time since new	: 9,475.3 hours
Date of last overhaul	: 4 April 2014
Total time at last overhaul	: 9,151.3 hours
Total time since overhaul	: 324.05 hours
Last 150 hour inspection	: 3 February 2015
Total engine hours at last inspection	: 9,442.6 hours
Engine hours since last inspection	: 32.7 hours
Total engine cycles at last inspection	: 11,349 cycles

1.7 Meteorological information

The prevailing meteorological conditions were not a factor in the occurrence. The weather en route was CAVOK²

1.8 Aids to navigation

Ground-based navigation aids, on-board navigation aids, aerodrome visual ground aids and their serviceability were not a factor in this occurrence.

1.9 Communications

Communications between the pilot and the load master on the ground were effective and were not a factor in the occurrence.

1.10 Aerodrome information

Not relevant to this occurrence.

² CAVOK. Ceiling and visibility OK. Visibility greater than 10 km; no clouds below 5000 ft or below the highest minimum safe sector altitude whichever is highest; no significant weather.

1.11 Flight recorders

The helicopter was not fitted with a flight data recorder or cockpit voice recorder. Neither recorder was required by the PNG Civil Aviation Act and Rules current at the time of the accident

1.12 Wreckage and impact information

The landing gear skids collapsed as a result of impact forces. The tail boom fractured and bent down immediately behind the fuselage. One main rotor blade fractured on impact and came to rest approximately 50 metres from the helicopter.



Figure 4: P2-HFZ impact site from rear of aircraft

1.13 Medical and pathological information

The pilot was flown to Port Moresby for medical treatment for the serious injuries sustained in the accident. He subsequently reported that his X-rays and CT scans revealed compression fractures on L1 and L5-S1 lumber sections. No pathological investigations were conducted as a result of this occurrence, nor were they required.

1.14 Fire

There was no evidence of pre-or post-impact fire.

1.15 Survival Aspects

The helicopter's cabin area remained intact and the pilot's safety harness did not fail in the impact.

1.16 Tests and Research

1.16.1 Engine testing

The engine was inspected in Port Moresby and evidence of metal splatter was observed on the nozzle heat shield of the engine combustor section, which indicated that the engine was running at the time of the impact.

The engine assembly was subsequently sent in a secure container to an approved Rolls-Royce engine overhaul facility in Brisbane, Australia for testing. The engine removal from the container and preparation for engine test running were carried out in the presence of representatives from Rolls-Royce Corporation (the engine manufacturer), Helifix Ltd., (the operator), Asia Pacific Aerospace (the engine test facility), and the PNG Accident Investigation Commission.

Six start attempts were unsuccessful resulting in *hung starts* due to the Gas Generator Turbine not accelerating beyond idle speed. (32% to 37% N1).

Additional inspections and checks of the engine and accessories were carried out. The fuel nozzle was shimmed and subsequently changed, and leak checks on all Pc air system pneumatic lines and unions were carried out before further starts were attempted. The Pc filter was removed and checked.

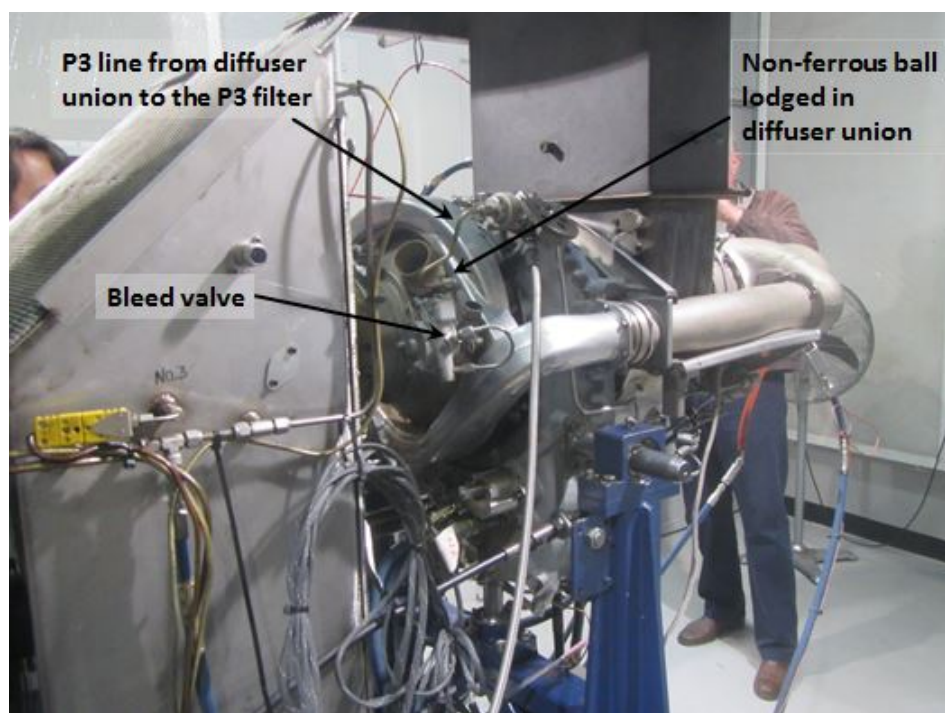


Figure 5: Pc line connection from the diffuser to the Pc filter



Figure 6: Disassembled Pc filter

After failure on the seventh start attempt, the decision was made to remove all Pc air lines and inspect them individually. First, the line from the diffuser to the Pc filter was removed. It was discovered that the union mount welded on the diffuser appeared to have an obstacle stuck in its orifice (it had the appearance of a drain valve). The bleed valve was removed to provide access for a boroscope to inspect the union internally. A ball-like foreign object stuck at the orifice of the Pc diffuser union was found. The engine manufacturer informed the AIC that ‘the foreign object which blocked the engine’s Pc air flow was consistent with the ceramic media used to provide a fine finish to various engine components. This finish is not provided by the Rolls-Royce factory, but is provided by third-party companies’.



Figure 7: The ‘foreign object’ stuck on inside of the union mount on diffuser



Figure 8: 'Foreign object' against a ruler in millimetres.

All technical personnel present agreed that the object lodged in the orifice was likely to have been the cause the engine's failure in service and all the hung on the test cell.

After removing the ball from the diffuser union, a normal engine start sequence was carried out, with all parameters including oil pressure, torque, turbine outlet temperature (TOT), and N1 indicating normally. The engine test run continued normally for another 30 to 40 minutes with power checks being made at different N1 settings.

Following the engine test run, the engine was released to the custody of the owner.

1.17 Organisational and Management Information

1.17.1 Owner / operator

Helifix Operations Ltd.,
PO Box 93
Port Moresby 111
National Capital District
Papua New Guinea

The date of the last maintenance carried out by the operator's approved maintenance organisation was listed in the log book as 2 February 2015. The log book entry was not signed in accordance with *Civil Aviation Rule 43.105, Certifying release-to-service after maintenance*. The log book entries for the maintenance carried out on 2 January 2015 and 28 December 2014 also were not signed.

1.17.2 Engine overhaul / maintenance organisation

The last engine overhaul was carried out at:

Gas Turbine Overhaul Pty. Ltd. Australia.

9 Fir St

Dingley Village

Victoria 3172

Australia

The investigation was unable to source any evidence of maintenance carried out since the last overhaul that could have allowed the non-ferrous ball to enter the Pc diffuser union. It is likely that the non-ferrous ball (referred to in Section 1.16.1 above) entered the Pc diffuser union during the last overhaul.

1.18 Additional Information

The small non-ferrous ball found in the Pc diffuser union orifice was of the material type used in pressure blast cleaning/polishing similar to the glass bead blasting process.

The engine underwent this form of blast cleaning/polishing at the last overhaul.

1.19 Useful or Effective Investigation Techniques

The investigation was conducted in accordance with Papua New Guinea Civil Aviation Act, Commissions of Inquiry Act, the Civil Aviation Rules, and the PNG Accident Investigation Commission's approved policies and procedures, and in accordance with the Standards and Recommended practices of Annex 13 to the Chicago Convention.

2 ANALYSIS

During a sling load release under the direction of a ground-based load master, the Bell 206 Long Ranger's engine failed. The investigation found that a small ball of non-ferrous material used in pressure cleaning had become lodged in the orifice of the Pc diffuser union effectively blocking the Pc air line.

The investigation was unable to conclusively determine when or how the ball had entered the Pc diffuser union. However, it is material used in pressure bead blasting to clean and shine the diffuser housing.

The engine underwent this form of cleaning at the last overhaul.

The blocked Pc air line caused a loss of air pressure to the engine's fuel control and power turbine governor, which caused engine power to hang at 'Ground Idle'. That was insufficient power to maintain flight.

3 CONCLUSIONS

3.1 Findings

3.1.1 Aircraft

- a) The maintenance records indicated that the aircraft was equipped and maintained in accordance with existing regulations and approved procedures.
 - However, the log book entries for the last two maintenance inspections were not signed.
- b) The aircraft was technically written up as being airworthy when dispatched for the flight.
 - However, the log book entries for the last three maintenance inspections were not signed.
- c) The mass and the centre of gravity of the aircraft were within the prescribed limits.
- d) The aircraft was structurally intact prior to impact.
- e) All control surfaces were accounted for, and all damage to the aircraft was attributable to the severe impact forces.
- f) The engine was running at 'Ground Idle' at impact, which was insufficient power for flight.
- g) There was no evidence of pre- or post-impact fire.

3.1.2 Pilot

- a) The pilot was licensed and qualified for the flight in accordance with existing PNG Civil Aviation Rules.

3.1.3 Flight operations

- a) The flight was conducted in accordance with the procedures in the company Operations Manual.
- b) There was insufficient height to conduct a successful auto-rotative landing.

3.1.4 Operator

- a) The maintenance records indicated that the aircraft was equipped and maintained in accordance with existing regulations and approved procedures.
 - However, the log book entries for the last three maintenance inspections were not signed.
-

3.1.5 Engine overhaul organisation

- a) It is likely that the non-ferrous ball (referred to in Section 1.16.1 of this report) entered the Pc diffuser union during the last engine overhaul.

3.1.6 Flight recorders

- a) The aircraft was not equipped with a flight data recorder (FDR) or a cockpit voice recorder (CVR); neither was required by PNG Civil Aviation Rules.

3.1.7 Medical

- a) There was no evidence that incapacitation or physiological factors affected the pilot's performance.

3.1.8 Survivability

- a) The helicopter cabin area remained intact and pilots safety harness did not fail during the impact.

3.2 Causes [Contributing factors]

A small ball of non-ferrous material used in pressure blast cleaning/polishing entered the Pc diffuser section of the air line and had become lodged in the orifice of the Pc diffuser union effectively blocking the Pc air line.

The investigation was unable to conclusively determine when or how the ball had entered the Pc line. It is likely that the non-ferrous ball entered the Pc diffuser union during the last engine overhaul.

The blocked Pc fuel line starved the engine of fuel at a critical time of the flight.

3.3 Other factors

The log book entries for the last three maintenance inspections were not signed in accordance with the requirements of *Civil Aviation Rule 43.105, Certifying release-to-service after maintenance*.

This safety deficiency was identified during the course of the investigation. While not causal to the accident, nevertheless it should be addressed.

4 SAFETY ACTIONS AND RECOMMENDATIONS

4.1 Recommendations

As a result of the investigation into the accident involving Bell 206 Long Ranger helicopter, registered P2-HFZ at Bobcat Rig site near Wabo, Gulf Province, on 15 February 2015, the PNG Accident Investigation Commission issues the following recommendations to address safety issues identified in this report.

4.1.1 Recommendation number AIC 15-R05/15-1001 to the Civil Aviation Safety Authority of PNG

The Accident Investigation Commission recommends that the Civil Aviation Safety Authority of PNG should note the operator's maintenance certification non-compliance with the requirements of *Civil Aviation Rule 43.105, Certifying release-to-service after maintenance*, and review the operators maintenance control recording systems and documentation.

4.1.2 Recommendation AIC 15-R06/15-1001to Helifix Ltd

The Accident Investigation Commission recommends that Helifix Ltd review its maintenance control recording and documentation procedures to ensure on-going compliance with the requirements of *Civil Aviation Rule 43.105, Certifying release-to-service after maintenance*.

4.1.3 Recommendation AIC 15-R07/15-1001 to Gas Turbine Overhaul Pty Ltd

The Accident Investigation Commission recommends that Gas Turbine Overhaul Pty Ltd review its maintenance practices to ensure that pressure bead blasting during cleaning and polishing cannot cause foreign objects ingestion/damage during engine overhaul.