

Interim report AO-2017-004: Forced landing into Porirua Harbour (Pauatahanui Arm),
MBB BK117A-3 Helicopter, ZK-IED, 2 May 2017

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Interim Report

Aviation inquiry AO-2017-004
Forced landing into Porirua Harbour
(Pauatahanui Arm)
MBB BK117A-3 Helicopter, ZK-IED
2 May 2017

Approved for publication: April 2018

Transport Accident Investigation Commission

About the Transport Accident Investigation Commission

The Transport Accident Investigation Commission (Commission) is a standing commission of inquiry and an independent Crown entity responsible for inquiring into maritime, aviation and rail accidents and incidents for New Zealand, and co-ordinating and co-operating with other accident investigation organisations overseas. The principal purpose of its inquiries is to determine the circumstances and causes of occurrences with a view to avoiding similar occurrences in the future. Its purpose is not to ascribe blame to any person or agency or to pursue (or to assist an agency to pursue) criminal, civil or regulatory action against a person or agency. The Commission carries out its purpose by informing members of the transport sector and the public, both domestically and internationally, of the lessons that can be learnt from transport accidents and incidents.

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Key Commission personnel

Chief Executive	Lois Hutchinson
Chief Investigator of Accidents	Captain Tim Burfoot
Investigator in Charge	Steve Walker
General Counsel	Cathryn Bridge

Email inquiries@taic.org.nz

Web www.taic.org.nz

Telephone + 64 4 473 3112 (24 hrs) or 0800 188 926

Fax + 64 4 499 1510

Address Level 16, 80 The Terrace, PO Box 10 323, Wellington 6143, New Zealand

Important notes

Nature of this report

This is not a complete report. It is an interim report that the Commission believes is necessary or appropriate in the interests of transport safety.

This interim report presents some of the facts and circumstances established up to this point in the Commission's inquiry, and contains no analysis or final conclusions. Any extrapolation of the information given in this report would be speculation.

Final report may include different information

The Commission will publish a final report on the accident after it completes its inquiry. That report will contain an analysis of the facts of the accident, findings and recommendations. The information contained in the Commission's final report may differ from the information contained in this interim report.

Citations and referencing

Information derived from interviews during the Commission's inquiry into the occurrence is not cited in this interim report. Documents that would normally be accessible to industry participants only and not discoverable under the Official Information Act 1982 have been referenced as footnotes only. Other documents referred to during the Commission's inquiry that are publicly available are cited.

Photographs, diagrams, pictures

Unless otherwise specified, photographs, diagrams and pictures included in this interim report are provided by, and owned by, the Commission.

Verbal probability expressions

The expressions listed in the following table are used in this report to describe the degree of probability (or likelihood) that an event happened or a condition existed in support of a hypothesis.

Terminology (adopted from the Intergovernmental Panel on Climate Change)	Likelihood of the occurrence/outcome	Equivalent terms
Virtually certain	> 99% probability of occurrence	Almost certain
Very likely	> 90% probability	Highly likely, very probable
Likely	> 66% probability	Probable
About as likely as not	33% to 66% probability	More or less likely
Unlikely	< 33% probability	Improbable
Very unlikely	< 10% probability	Highly unlikely
Exceptionally unlikely	< 1% probability	




MBB BK117A-3 helicopter, ZK-IED

(Courtesy of Precision Helicopters)



Legend

 Porirua Harbour,
(Pauatahanui Arm)

Location of accident

Source: mapsof.net

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Abbreviations

Commission Transport Accident Investigation Commission

MBB Messerschmitt-Bölkow-Blohm GmbH

Glossary

chord the measurement from the leading edge to the trailing edge, essentially the width of the blade

Data summary

Aircraft particulars

Aircraft registration:	ZK-IED
Type and serial number:	Messerschmitt-Bölkow-Blohm GmbH BK117A-3, 7059
Number and type of engines:	two Honeywell LTS 101-650 B-1 turbo-shaft
Year of manufacture:	1985
Type of flight:	commercial lifting
Persons on board:	one
Pilot's licence:	commercial pilot licence (helicopter)
Pilot's age:	64
Pilot's total flying experience:	8,000 flight hours (approximately)

Date and time 2 May 2017, 1137¹

Location Pauatahanui Inlet, Porirua
latitude: 41° 5.8' south
longitude: 173° 53.1' east

Persons on board one (pilot)

Injuries one (minor)

Damage substantial

¹ Times in this report are in New Zealand Standard Time and expressed in the 24-hour format.

1. Conduct of the inquiry

- 1.1. The New Zealand Civil Aviation Authority notified the Transport Accident Investigation Commission (Commission) of the accident at 1150 on Tuesday 2 May 2017. The Commission opened an inquiry under section 13(1) of the Transport Accident Investigation Commission Act 1990 and appointed an investigator in charge. A Commission investigator arrived at the accident site at 1630 on 2 May 2017, and made an initial assessment of the circumstances.
- 1.2. The next day Commission investigators began to supervise the recovery of the helicopter from the harbour, and conduct interviews with witnesses and other relevant persons.
- 1.3. On 4 May 2017, in accordance with Annex 13 to the Convention on International Civil Aviation, the Commission notified the accident to the air accident investigation authority of Germany, the state of manufacture of the helicopter. The Bundesstelle für Flugunfalluntersuchung appointed one of its investigators as its Accredited Representative and appointed Airbus Helicopters as a technical adviser.
- 1.4. The Commission also notified the accident to the National Transportation Safety Board of the United States, the state of manufacture of the engine. The Board did not appoint an Accredited Representative, but offered technical support as required.
- 1.5. The helicopter was recovered from the harbour on 4 May 2017, and transported to the Commission's secure technical facility for further examination. On 6 May 2017 a utility pole, which was being underslung at the time of the accident, was recovered. It was weighed two weeks later by the electricity company that had contracted the helicopter operator.
- 1.6. On 16 May 2017 the Commission's investigators conducted a teleconference with the Bundesstelle für Flugunfalluntersuchung and Airbus Helicopters advisers.
- 1.7. On 19 May 2017 an expert metallurgist conducted an initial assessment of a failure on the vertical tail fin spar².
- 1.8. On 6 June 2017 an Airbus Helicopters engineer travelled to New Zealand to assist the Commission with the technical examination of the helicopter. The Commission also engaged a consultant engineer experienced with the helicopter type to assist with the investigation. The failed sections of the vertical tail fin were then sent to the metallurgist for a more detailed examination.
- 1.9. A Garmin mobile global positioning system (GPS) device recovered from the helicopter was sent to the Australian Transport Safety Bureau, which successfully retrieved the data for the flight.
- 1.10. The Commission secured maintenance documents for the helicopter involved in the crash. The Commission also obtained maintenance records for other helicopters that had components exchanged with the crashed helicopter.
- 1.11. The Commission notified the Civil Aviation Authority on 21 December 2017 of a safety issue identified early in the inquiry.
- 1.12. On 21 February 2018 the Commission approved the circulation of this draft interim report to four interested persons for comment.
- 1.13. Three submissions were received. The Commission took these into consideration, and changes as a result of those submissions have been included in the final report.
- 1.14. On 19 April 2018 the Commission approved the publication of this interim report.

² A structural member of the vertical tail fin.

2. Factual information

The circumstances of the accident

- 2.1. On 2 May 2017 a Messerschmitt-Bölkow-Blohm GmbH (MBB) BK117A-3 helicopter, registration ZK-IED (the helicopter), was to be used for lifting hardwood utility poles from a staging area, across the Pauatahanui Inlet and then placing them into holes that had been prepared by the electricity company. Each underslung load was to consist of one 11-metre-long utility pole.
- 2.2. On the morning of the accident the pilot arrived at the staging area by road, to brief the electricity company ground crew and prepare for the planned lifting operation.
- 2.3. The pilot attached a 20-metre lifting strop to the first pole lying on the ground. The poles had not been weighed prior to the operation. The pilot estimated that the first pole weighed about 800 kilograms. The weight of the pole was later confirmed to be 959 kilograms.
- 2.4. The weather in the Porirua area was reported by MetService³ to be good visibility, partly cloudy, with a northerly or north-westerly wind of eight knots, occasionally gusting to 20 knots. The temperature was 13.5 degrees. Witnesses in the area confirmed these conditions.
- 2.5. Another pilot ferried the helicopter from its base to the staging area. Following about a three-minute exchange, the pilot took off and hovered the helicopter while a member of the ground crew attached the lifting strop to the hook. The helicopter then lifted the pole and climbed vertically to approximately 120 feet (37 metres). The helicopter then moved forward to a speed of about 40 knots and climbed to approximately 230 feet (71 metres) above the water towards the first work site.
- 2.6. The pilot later said that, as the helicopter was slowing for the approach to the work site, he felt the airframe begin to vibrate, followed by a sudden rotation to the right with pitch oscillations.
- 2.7. Witnesses on both the northern and southern sides of the harbour described the helicopter spinning while descending and striking the water.
- 2.8. As the helicopter rolled on to its right side the main rotor blades struck the water while under power, and were destroyed.
- 2.9. The pilot was wearing a safety helmet. He was able to extricate himself from the wreckage and climb on top of the helicopter (see Figure 1), from where he was rescued and taken to hospital. He suffered minor injuries.

³see <http://www.metservice.com/national/home>



Figure 1
Pilot awaiting rescue

The pilot

- 2.10 The pilot's total flying experience was more than 8,000 hours, with about 7,000 of those hours on various helicopter types.
- 2.11 At the time of the accident the pilot held a class 1 medical certificate.

The helicopter

- 2.12 The BK117A-3 helicopter is powered by two turboshaft engines. It has a rigid main rotor system comprising four fibre-reinforced main rotor blades connected to a titanium rigid rotor head. The drive from the engines is transmitted forward to the main rotor transmission through drive shafts with flexible couplings. Each drive shaft is connected to a freewheel assembly integrated with the main rotor gearbox.
- 2.13 The tail rotor comprises a semi-rigid, two-blade 'pusher' rotor on the left side of the vertical fin, with a central flapping hinge and glass-fibre-reinforced-plastic tail rotor blades. The tail rotor gearbox is fitted to the top of the vertical fin, with the tail rotor drive connecting to it via an intermediate transmission.
- 2.14 The tail rotor system has a yaw stability augmentation system, which applies limited control inputs to the tail rotor through an electro-hydraulic servo. The control switch for this system, located in the cockpit, was selected on as was normal.
- 2.15 The helicopter had been manufactured in Germany and imported to New Zealand from the United States in January 2014, with a total time in service of 11,123 hours.
- 2.16 Prior to October 2014, Rick Lucas Helicopters Limited, trading as Helipro, had used multiple helicopter types to conduct aerial services. Helipro was certificated as an air operator under Civil Aviation Rules Part 119 and as a maintenance provider under Civil Aviation Rules Part 145.
- 2.17 The helicopter had been registered by Helipro as ZK-IED on 26 March 2014 and issued with a New Zealand Civil Aviation Authority airworthiness certificate on 21 August 2014. However, at the time of the accident the helicopter was operating under another company's air operator certificate.

2.18 ZK-IED had flown a total of about 11,512 hours at the time of the accident. An annual review of airworthiness had been completed on 24 October 2016. The last scheduled maintenance had been a 50-hour airframe inspection carried out on 18 November 2016.

Technical examination

2.19 Commission investigators carried out a detailed examination of the recovered helicopter, with assistance from an Airbus Helicopters engineer and a Commission-appointed independent engineer experienced with the helicopter type.

2.20 The main rotor blades had been destroyed. However, aside from deformation of skin panels on the underside, the helicopter fuselage was relatively undamaged. A twist was evident in the tail boom.

2.21 The left engine drive shaft to the main rotor transmission had failed due to torsional overload (see Figure 2). The associated freewheel assembly had not failed.

2.22 In comparison, the right engine drive shaft to the main rotor transmission was only partially twisted and the freewheel assembly had failed.

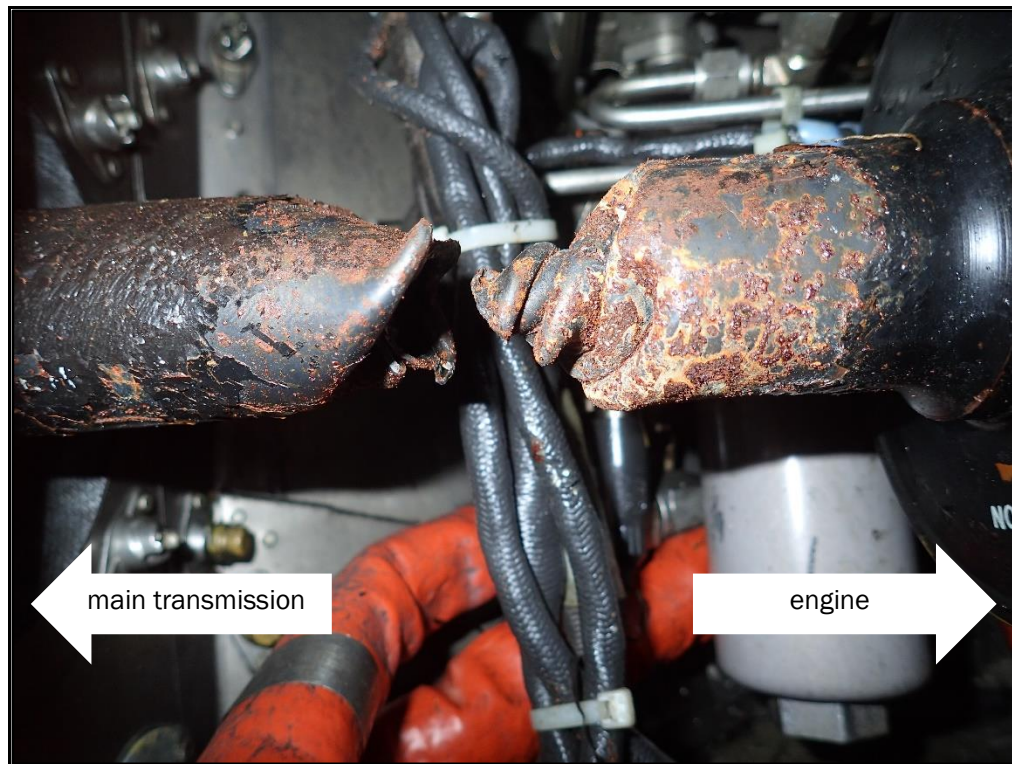


Figure 2
Failure of left-side engine driveshaft

2.23 The tail rotor blades and the tail rotor drive were intact. The primary structure of the vertical fin that supported the tail rotor gearbox had failed on the left side (see Figure 3) and there was a crack running diagonally through the fin spar (see Figure 4).

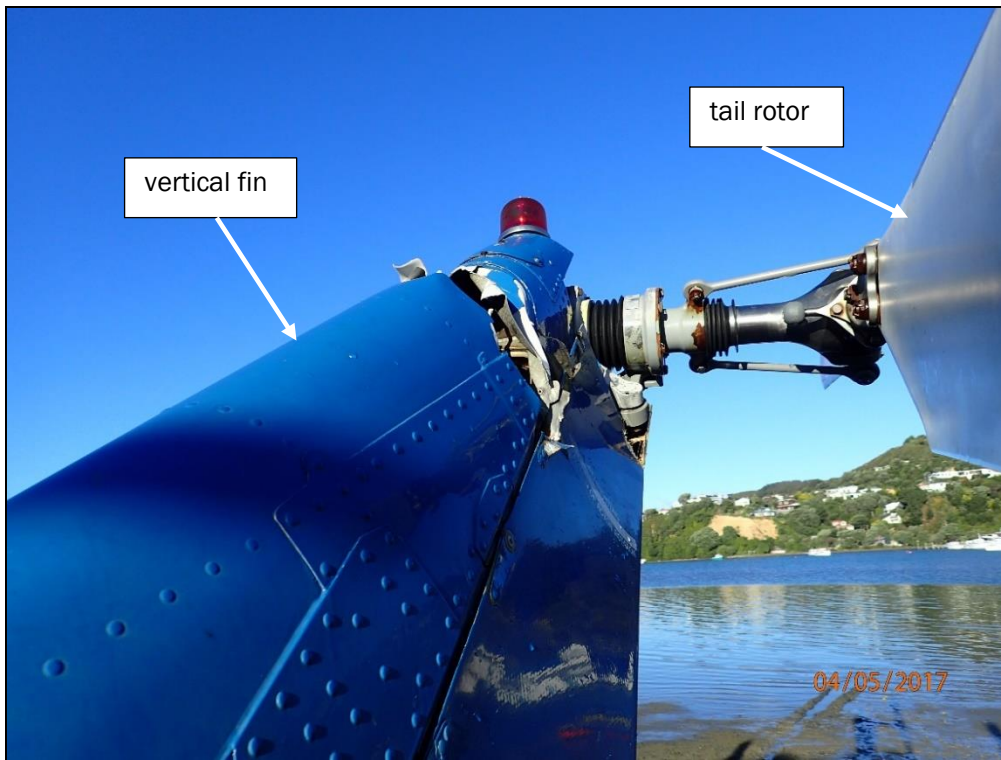


Figure 3
Failed vertical fin

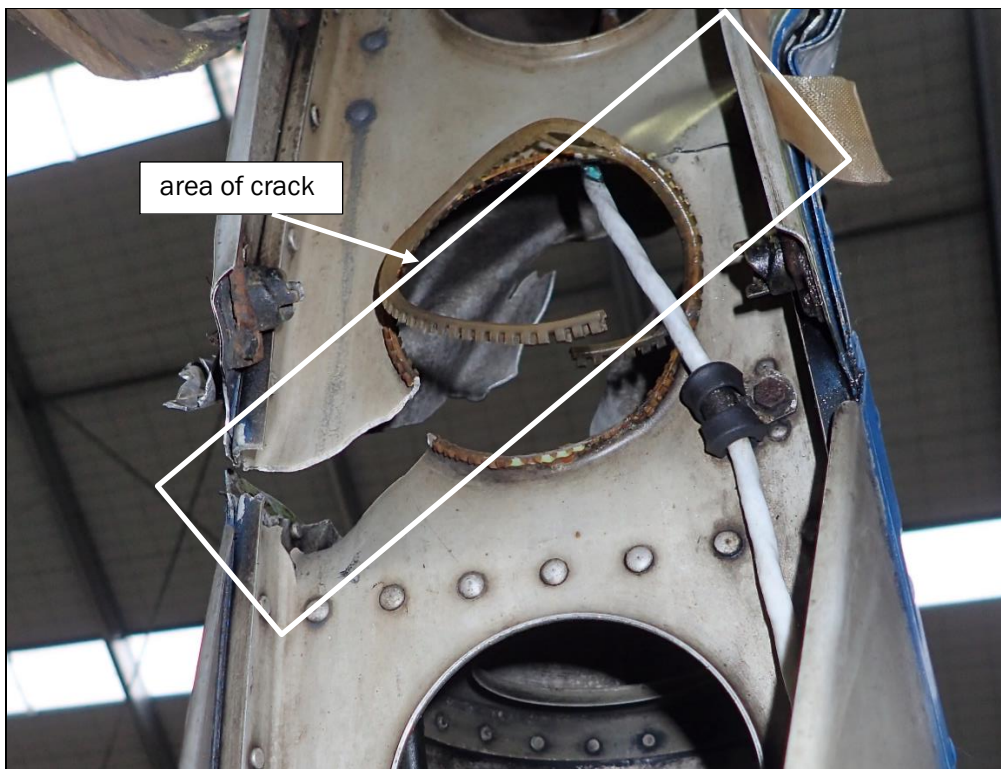


Figure 4
Crack through vertical fin spar

- 2.24 An expert metallurgical examination determined that this failure and associated cracking had occurred as a result of the helicopter's forced landing and had not been present prior to the accident.

Tail rotor maintenance anomalies

- 2.25 The helicopter type was originally fitted with narrow-chord⁴ tail rotor blades. The tail rotor blades that had been recorded as fitted when the helicopter was exported to New Zealand were the wide-chord type, which was a modification introduced by Eurocopter Service Bulletin SB-MBB-BK 117-30-105 to improve tail rotor performance. However, the blades fitted to the helicopter at the time of the accident were the narrow-chord type.
- 2.26 This suggests that the wide-chord tail rotor blades had been exchanged for the narrow-chord type after the helicopter had been imported. No records could be found for the change of the tail rotor blades from wide chord to narrow chord. The helicopter manufacturer advised that there was no approved instruction for the reverse modification of wide-chord tail rotor blades to narrow-chord tail rotor blades.
- 2.27 Additionally, the serial numbers of the tail rotor blades were not visible. Where the serial numbers should have been displayed, the underlying composite structure of the blades had been left exposed without a reapplication of paint or sealing product (see Figure 5).
- 2.28 The tail rotor hub fitted to the helicopter at the time of the accident had the part number required for wide-chord tail rotor blades. This meant the hub did not have the correct part number for the narrow-chord blades that were fitted to the helicopter.

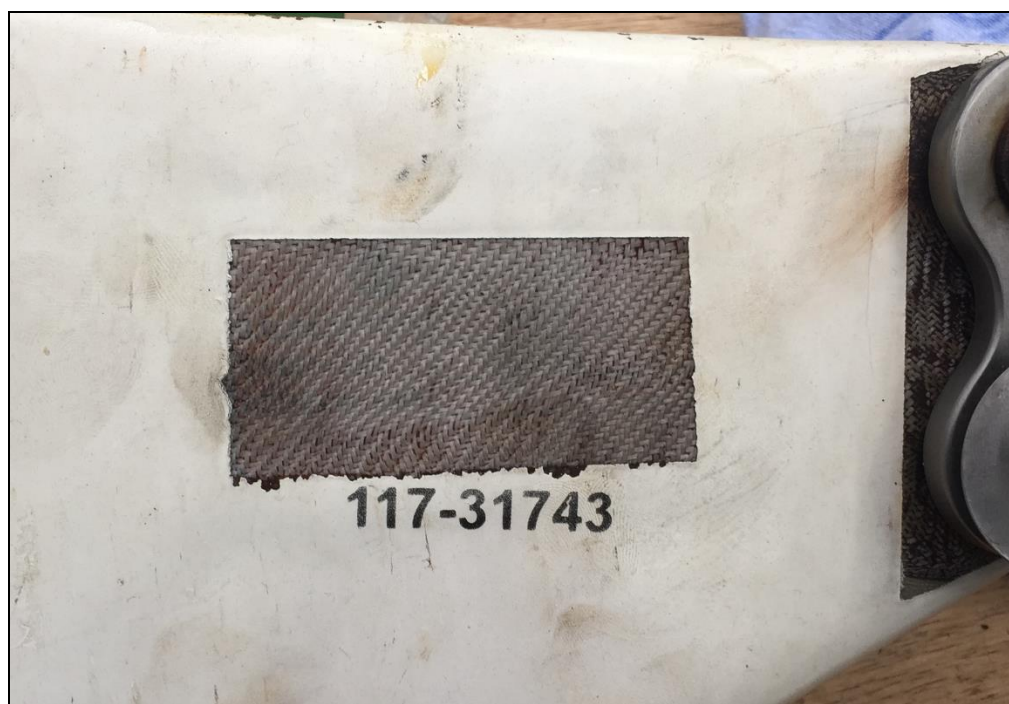


Figure 5
Photograph showing the area of exposed composite structure
where the serial number would normally have been displayed

Other maintenance anomalies

- 2.29 At the same time that the accident helicopter was imported in 2014, a MBB BK117A-4 type helicopter (serial number 7124) was imported by Helipro and subsequently registered as ZK-IPP, but it was never issued with an airworthiness certificate and the registration lapsed. ZK-IPP was then stored at the premises of Helipro's chief pilot.
- 2.30 Prior to the Civil Aviation Authority inspecting the helicopter for the issue of a New Zealand certificate of airworthiness, various swaps of components and various modifications had

⁴ The measurement from leading edge to the trailing edge, essentially the width of the blade.

been carried out by engineers approved under Helipro's Civil Aviation Rule Part 145 exposition. Both engines had been changed for the engines that were originally on ZK-IPP. This change had been recorded in maintenance worksheets; however, there was no reference to, or record of, any conformity inspection or approved release being carried out on the engines by an appropriately authorised person.

- 2.31 Maintenance logbook entries showed that, after the helicopter had been imported in January 2014, its freewheel assemblies had been removed on 20 March 2014 and installed in a Kawasaki BK117 (registration ZK-HYZ) operated by Helipro at the time. This work had been undertaken by engineers authorised under Helipro's Civil Aviation Rule Part 145 exposition. The freewheel assemblies being replaced had overrun their life limits by 17.1 hours.
- 2.32 The maintenance records for transferring the freewheel assemblies from the helicopter to ZK-HYZ recorded that they had a significantly longer time in service remaining than the recorded time in service remaining when they were imported on the helicopter.
- 2.33 At the time of the accident the freewheel assemblies fitted to the helicopter to replace those moved to ZK-HYZ were those imported with ZK-IPP. To date, nothing has been found in the maintenance records on the installation of the replacement freewheel assemblies that had been fitted to the helicopter.

Safety issue

- 2.34 The Commission is concerned that other aircraft previously operated by Helipro could have historical maintenance issues that could compromise aviation safety.
- 2.35 The Commission investigators identified maintenance anomalies in the records for three other BK117 helicopters previously operated by Helipro, including ZK-HYZ. The number and nature of the maintenance anomalies involving the accident helicopter and the three other helicopters create a serious safety issue.
- 2.36 Given that Helipro was operating or maintaining a large number of other aircraft at the time, the Commission is concerned that there could be historical or latent maintenance issues with some of those aircraft as well. These aircraft have all been on-sold and are currently being operated on the New Zealand register by various other companies.
- 2.37 The Commission raised this safety issue with the New Zealand Civil Aviation Authority for it to address. In response, the Civil Aviation Authority issued a Continuing Airworthiness Notice to notify owners and operators of possible significant anomalies with the maintenance and engineering practices relating to certain aircraft. The full notice is included in Appendix 1.

3. Further lines of inquiry

- 3.1 The current and future lines of inquiry include, but are not limited to, the following topics:
- further examination of the wreckage
 - explanation for the pilot's reported loss of control
 - further witness interviews
 - consideration of the implications of having the narrow-chord tail rotor blades fitted
 - a review of any similar occurrences
 - the circumstances regarding the issue of the New Zealand airworthiness certificate.

Appendix 1: Continuing Airworthiness Notice (CAN) 05-008

Continuing Airworthiness Notice – 05-008 Revision 1

Maintenance History - Review

15 January 2018



Issued by the Civil Aviation Authority of New Zealand in the interests of aviation safety. A Continuing Airworthiness Notice (CAN) is intended to alert, educate, and make recommendations to the aviation community. A CAN contains non-regulatory information and guidance that does not meet the criteria for an Airworthiness Directive (AD). The inspections and practices described in this CAN must still be carried out in accordance with the applicable NZCAR Parts 21, 43 and 91. CAN numbering is by ATA Chapter followed by a sequential number for the next CAN in that ATA Chapter.

Applicability:

All aircraft previously operated by Rick Lucas Helicopters Limited, or previously operated by Helipro Aviation Training Limited, including aircraft previously maintained by Helipro Aviation Support Limited. This Continuing Airworthiness Notice (CAN) is not applicable to aircraft operated or maintained by Helipro (Fiji) Limited.

Purpose:

The purpose of this CAN is to notify current owners/operators of aircraft that were previously operated by Rick Lucas Helicopters Limited and Helipro Aviation Training Limited, and aircraft that were previously maintained by Helipro Aviation Support Limited of possible significant anomalies with the maintenance and engineering practices that may exist.

Background:

This CAN is prompted by a Transport Accident Investigation Commission (TAIC) investigation into an accident involving a MBB-BK117 helicopter.

While researching the maintenance history of the accident helicopter, the TAIC investigators found what appears to be significant anomalies with the maintenance and engineering practices applied to the accident helicopter.

Both TAIC and the CAA are concerned that if similar maintenance and engineering practices were carried out on other aircraft previously operated by Rick Lucas Helicopters Limited or other aircraft previously operated by Helipro Aviation Training Limited, and aircraft previously maintained by Helipro Aviation Support Limited, then those aircraft could be at risk. The current owners/operators of those aircraft could be unaware of that risk. (Occurrence 17/8039 refers).

Requirements:

An engineer with an Inspection Authorisation (IA) shall determine if the aircraft was previously operated by Rick Lucas Helicopters Limited, or operated by Helipro Aviation Training Limited, or if the aircraft was previously maintained by Helipro Aviation Support Limited, in the period commencing 1 January 2012 onwards.

If the aircraft is affected, then the IA shall review the maintenance actions accomplished on the aircraft and determine if any life limited parts (including finite life and manufacturer's recommended overhaul life) have been released to service by persons working for Rick Lucas Helicopters Limited, or Helipro Aviation Support Limited.

If any person working for these companies has issued a release to service for maintenance associated with any life limited part, then accomplish the following actions:

- Determine that the life limited part is approved for installation on the aircraft model.
- Check the physical P/N and S/N of the affected life limited part installed on the aircraft.
- Determine that acceptable records, including component log cards, a Form 1 and/or a Form 2 document is available for the affected part. The documentation must demonstrate that the manufacturer life limitations have not been exceeded for the affected part.
- Complete a CA005 Defect Report form for every aircraft reviewed regardless of whether or not any anomalies were found.
- Accomplish appropriate corrective actions before further flight.

Accomplish the aforementioned requirements and actions by 28 February 2018.

A CA005 Defect Report form can be obtained from http://www.caa.govt.nz/Forms/CA005D_Form.pdf

The completed form can be emailed to the CAA at CA005@caa.govt.nz

Enquiries:

Enquiries with regard to the content of this Continued Airworthiness Notice should be sent to:

Shaun Johnson

Manager Airworthiness Unit

Email: shaun.johnson@caa.govt.nz

Phone: 04 560 9444



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AO-2016-006	Eurocopter AS350-B2, ZK-HYY, Collision with terrain during scenic flight, Mount Sale, near Arrowtown, 12 September 2016
AO-2015-003	Robinson R44, Main rotor blade failure, Waikaia, Southland, 23 January 2015
AO-2014-005	Eurocopter AS350-B2 (ZK-HYO), collision with terrain, during heli-skiing flight, Mount Alta, near Mount Aspiring National Park, 16 August 2014
AO-2015-005	Unplanned interruption to national air traffic control services, 23 June 2015
AO-2016-004	Guimbal Cabri G2, ZK-IIIH, In-flight fire, near Rotorua Aerodrome, 15 April 2016
AO-2015-001	Pacific Aerospace Limited 750XL, ZK-SDT, Engine failure, Lake Taupō, 7 January 2015
AO-2013-010	Aérospatiale AS350B2 'Squirrel', ZK-IMJ, collision with parked helicopter, near Mount Tyndall, Otago, 28 October 2013
Addendum to final report AO-2015-002	Mast bump and in-flight break-up, Robinson R44, ZK-IPY, Lochy River, near Queenstown, 19 February 2015
Interim Report AO-2017-001	Collision with terrain, Eurocopter AS350-BA, ZK-HKW, Port Hills, Christchurch, 14 February 2017
AO-2013-011	Runway excursion, British Aerospace Jetstream 32, ZK-VAH, Auckland Airport, 2 November 2013
AO-2014-006	Robinson R44 II, ZK-HBQ, mast-bump and in-flight break-up, Kahurangi National Park, 7 October 2014
Interim Report AO- 2016-007	Collision with terrain, Robinson R44, ZK-HTH, Glenbervie Forest, Northland, 31 October 2016
AO-2014-004	Piper PA32-300, ZK-DOJ, Collision with terrain, Near Poolburn Reservoir, Central Otago, 5 August 2014
AO-2015-002	Mast bump and in-flight break-up, Robinson R44, ZK-IPY, Lochy River, near Queenstown, 19 February 2015

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