Australian Government
Australian Transport Safety Bureau

Forced landing and ground fire involving a Robinson R44, VH-YYS

56 km east of Archer River, Queensland on 23 November 2014

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Aviation Occurrence Investigation
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Published by: Australian Transport Safety Bureau
Postal address: PO Box 967, Civic Square ACT 2608
Office: 62 Northbourne Avenue Canberra, Australian Capital Territory 2601
Telephone: 1800 020 616, from overseas +61 2 6257 4150 (24 hours)
Accident and incident notification: 1800 011 034 (24 hours)
Facsimile: 02 6247 3117, from overseas +61 2 6247 3117
Email: atsbinfo@atsb.gov.au
Internet: www.atsb.gov.au

Addendum

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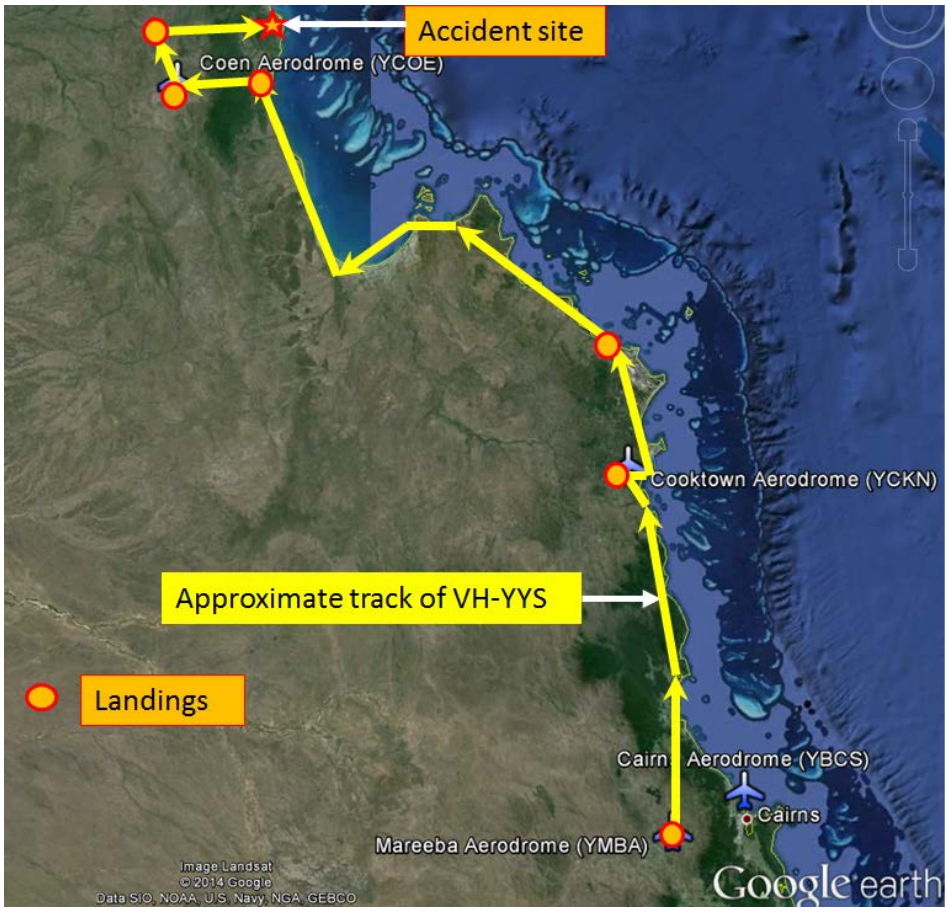
Forced landing and ground fire involving a Robinson R44, VH-YYS

What happened

On 22 November 2014, at about 0600 Eastern Standard Time, a Robinson R44 helicopter, registered VH-YYS, departed from Mareeba, Queensland on a private flight with the pilot and one passenger on board. The helicopter had previously been flown for 4.4 hours following an engine overhaul and the pilot had expressed concern about the quantity of oil the engine was consuming following the overhaul. He was advised by the licenced aircraft maintenance engineer who had conducted the overhaul to take the helicopter for a longer flight, of up to 7 hours, to 'bed in'[1] the engine. The passenger was an employee of a local aircraft maintenance company that had installed the engine in the helicopter following the overhaul. The pilot had asked the passenger to accompany him on the flight due to his concerns about the engine.

The helicopter tracked to the coast from Mareeba, then flew coastal to Cooktown where the pilot landed and refuelled (Figure 1). The helicopter had used about 1 L of oil during the 1.5 hour flight, and the pilot added that amount of oil prior to lifting off and continuing north. About 1 hour later, the pilot landed in a clearing on the coast, allowed the engine to cool and conducted an external inspection. He wiped away some oil that was smeared on the rear two cylinder heads.

Figure 1: Approximate aircraft track and landing sites



Source: Google earth and pilot recollection

[1] The aim of bedding in an engine was to settle the piston rings into the cylinder wall.

From there the helicopter continued over Princess Charlotte Bay and Silver Plains and the pilot again landed and allowed the engine to cool. He wiped some oil from the cylinder heads but was unsure whether that oil leakage was normal while the engine bedded in, and whether it was leaking from the cylinders or being distributed there from the breather. The pilot did not add oil at that stage and departed for the 15 minute flight to Coen.

After landing in Coen, the pilot refuelled the helicopter and added 1 L of oil to bring the total oil quantity back up to 8 L. At about 1300, the helicopter departed Coen for Archer River. After arriving in Archer River, the pilot conducted another external inspection of the helicopter and did not add any oil. The helicopter lifted off at about 1400 and planned to track to the coast and then back to Cooktown.

When about 30 NM from Archer River and at about 1,300 ft, the pilot observed the engine revolutions per minute (rpm) decreasing rapidly. He immediately entered an autorotation: lowered the collective[2], rolled off the throttle and advised the passenger to brace for impact. The pilot sighted a clearing ahead and aimed to land there. During the descent, he observed the low rotor rpm (RRPM) caution light illuminate, but did not recall hearing the low RRPM warning horn. He turned the helicopter directly into wind and levelled it with the cyclic[3].

As the helicopter neared the ground, the pilot saw that they were landing into tall guinea grass. As soon as the helicopter landed, the pilot locked the cyclic off, retrieved the emergency beacon and he and the passenger quickly exited the helicopter. The pilot observed smoke billowing from the rear of the helicopter, where heat from the helicopter's exhaust ignited a grass fire. They ran away from the helicopter and grassed area towards trees and within seconds the helicopter was engulfed by fire. The helicopter was subsequently destroyed and the pilot and passenger were uninjured (Figure 2). The helicopter had been fitted with bladder fuel tanks.

Figure 2: Accident site

Source: Provided to the ATSB

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2 A primary helicopter flight control that simultaneously affects the pitch of all blades of a lifting rotor. Collective input is the main control for vertical velocity.

3 A primary helicopter flight control that is similar to an aircraft control column. Cyclic input tilts the main rotor disc varying the attitude of the helicopter and hence the lateral direction.

Engine history

The helicopter was fitted with a Lycoming O-540-F185 engine, serial number L-26764-40E.

23 June 2014: Total time in service (TTIS) 890.6 hr

On 23 June 2014, following a sudden stoppage and engine overspeed, the engine was removed from the helicopter for a bulk strip. Maintenance records indicated that the following items were subsequently fitted: left magneto, right magneto, carburettor, oil cooler, cylinders 1-6, and a starter motor.

29 September 2014: TTIS 890.6

On 29 September 2014, the repaired engine was returned to a licensed aircraft maintenance engineer and installed in the helicopter.

When the pilot/owner collected the helicopter he observed that it was low on oil and added 2 L to bring the oil quantity to 8 L. He was advised that this had probably been taken up in the filters following initial engine runs. After completing a number of circuits at the airport, the pilot flew the helicopter to the home property. He observed that although the cylinder head temperature and oil temperature gauges were indicating in the green range, both were noticeably higher than prior to the engine maintenance.

17 October 2014: TTIS 896.3

On 17 October, the pilot conducted a flight in the helicopter and, particularly when operating in the range of about 80-90 kt, detected a 'kick' in the cyclic. He initially assessed this as an issue with the blade track and reported it to the maintenance engineer. The engine was using about 1 L of oil every 15 minutes and the pilot was concerned about the high rate of oil consumption, as well as the higher operating cylinder head and oil temperatures. Prior to the engine overhaul, the oil consumption was about 0.2 L/hr and the normal operating cylinder head temperature and oil temperature had been lower.

He returned the helicopter to the engineer and they conducted a short test flight. The engineer observed the 'kick' in the cyclic, coinciding with a marked drop in engine rpm.

The maintenance log recorded 'Engine using excessive oil removed for repairs'.

21 October 2014 Service Difficult Report (SDR) submitted:

On 21 October, the engineer submitted the following SDR report to CASA:

> Aircraft rebuilt after heavy landing overspeed incident. On completion of the rebuild, aircraft flown for approximately 4 hours within that time the pilot/owner noticed a kick in the aircraft as it was flown resembling a lateral vibration. He also mentioned that the oil consumption was quite high. On inspection the oil was down to 5 quarts. We put 2 quarts in and did a track and balance believing the vibration was a lateral related balance issue. On completing the first flight it was apparent that the lateral was related to an engine miss. On landing we checked the oil consumption again and it was down to 6 quarts[4].
>
> Investigation results: It was decided to remove the plugs; all had excessive oil present on the plugs. Boroscope of the cylinders was carried out noting excessive wear of the cylinder timings. It was decided to remove the engine, return it to the engine shop for inspection. On removal also noticed No. 2 and No. 6 cylinders had loose cylinder base nuts.

29 October 2014: TTIS 896.3

The following maintenance record was entered by the engine repairer on 29 October:

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[4] 1 litre is equivalent to about 1.06 quarts

> Engine received for investigation of high oil consumption and evidence of several loose studs. High oil consumption was found to be caused by cylinder 2 and 4 having the rings gaps aligned and evidence of corrosion in the upper portion of the cylinder, all cylinders pitted beyond repair and replaced by 6 overhauled cylinders. Back bone bolts re-torqued. Note there was no evidence of any oil leaks from the studs found to be left loose after engine has operated for 8.2 hours.

14 November 2014: 4.4 hour flight

On 14 November, the pilot retrieved the helicopter from the engineer and conducted a flight from Mareeba to Cooktown and return. He reported that there was some oil on the cylinders following the flight, but it was only a smear. He had landed a few times along the way and reported that the oil consumption on that flight was about 1.5 L/hr. Following this flight he was advised to take the helicopter for a longer flight to bed the engine in. This flight led to the forced landing.

Engineering inspection

Following the accident, the engine was inspected by the engineer who had conducted the engine overhaul. A full engine strip down was not conducted. The magnetos were badly fire damaged and it was not possible to determine their serviceability at the time of the accident. As a result, the cause of the reduced engine rpm was not determined.

Grass fire risk

Since 2000, 14 occurrences of a helicopter being destroyed by grass fire have been reported to the ATSB. Many of the reports highlighted the speed with which the grass ignited and the rapid spread of the fire. In November 2002, Robinson Helicopter Company published *Service Bulletin SB-46*,[5] which recommended that shields could be installed on the exhaust collectors and tailpipe to reduce the chance of grass fire. All Robinson R44 helicopters serial number 1270 and subsequent were fitted with aluminium shields on the exhaust collector and tailpipe, to reduce the chance of grass fire. VH-YYS had a serial number of 1801, indicating that the shields had been fitted during the manufacturing process.

A review of the post-accident photographs found presence of the stainless steel brackets and clamps indicating that these shields had been fitted; however the actual aluminium shields were not observed and may have melted in the ensuing fire.

Safety message

In this incident, the pilot was concerned about the serviceability of the helicopter. The cause of the loss of power was unable to be determined. The incident highlights the importance of pilot decision making in determining whether to conduct and/or continue a flight when abnormal indications such as excessive oil consumption occur.

Robinson R44 helicopters have exhaust systems that are low to the ground. The ground to muffler height on a new R44 is about 49 cm. The Pilot Operating Handbook for all R44s has a note in Section 10, Safety Tips stating:

> Do not land in tall dry grass. The exhaust is low to the ground and very hot; a grass fire may be ignited.

The pilot conducted a successful autorotation, but the helicopter was destroyed by the subsequent fire. When conducting a forced or precautionary landing, pilots may have limited choices for a suitable landing site. When time permits, the dangers of landing on grass, especially in areas of high temperatures and low humidity should be included when planning and assessing suitable landing sites.

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[5] www.robinsonheli.com/service_library/r44_service_bulletins/r44_sb46.pdf

General details

Occurrence details

Date and time:	22 November 2014 – 1430 EST	
Occurrence category:	Accident	
Primary occurrence type:	Abnormal engine indications	
Location:	56 km E Archer River, Queensland	
	Latitude: 13° 29.45' S	Longitude: 143° 26.27' E

Helicopter details

Manufacturer and model:	Robinson Helicopter Company R44	
Registration:	VH-YYS	
Serial number:	1801	
Type of operation:	Private	
Persons on board:	Crew – 1	Passengers – 1
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Nil	

About the ATSB

The Australian Transport Safety Bureau (ATSB) is an independent Commonwealth Government statutory agency. The ATSB is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers. The ATSB's function is to improve safety and public confidence in the aviation, marine and rail modes of transport through excellence in: independent investigation of transport accidents and other safety occurrences; safety data recording, analysis and research; and fostering safety awareness, knowledge and action.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to fare-paying passenger operations.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and Regulations and, where applicable, relevant international agreements.

The object of a safety investigation is to identify and reduce safety-related risk. ATSB investigations determine and communicate the safety factors related to the transport safety matter being investigated.

It is not a function of the ATSB to apportion blame or determine liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

About this report

Decisions regarding whether to conduct an investigation, and the scope of an investigation, are based on many factors, including the level of safety benefit likely to be obtained from an investigation. For this occurrence, a limited-scope, fact-gathering investigation was conducted in order to produce a short summary report, and allow for greater industry awareness of potential safety issues and possible safety actions.