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- safety data recording, analysis and research
- fostering safety awareness, knowledge and action.

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ATSB TRANSPORT SAFETY REPORT
Aviation Occurrence Investigation A0-2012-021
Preliminary

Collision with terrain Jaspers Brush Aerodrome, New South Wales 4 February 2012

Abstract

At about 1555 Eastern Daylight-saving Time on 4 February 2012, a Robinson Helicopter Company R44 Raven II helicopter, registered VH-COK, lifted off from Jaspers Brush Aerodrome, New South Wales for an aerial filming task at Jervis Bay. On board were the pilot and a camera operator.

Soon after lifting off, the pilot's door opened. The helicopter abruptly pitched nose-up and the tailskid struck the ground. The helicopter then abruptly pitched forward and rolled to the right before the main rotor blades struck the ground. A fuel-fed fire started in the vicinity of the fuel tanks and lower mast area. The fuselage then hit the ground. Both occupants were fatally injured and the helicopter was destroyed.

On 20 December 2010, the manufacturer issued R44 Service Bulletin 78 (SB 78) requiring that R44 helicopters with all-aluminium fuel tanks be retrofitted with bladder-type fuel tanks as soon as practical, but no later than 31 December 2014. At the time of the accident, about 90% of the helicopters originally fitted with all-aluminium fuel tanks, including VH-COK, had not been retrofitted. On 21 February 2012, the manufacturer issued SB 78A that revised the date of compliance to 31 December 2013.

In addition, the manufacturer released SB 82 in respect of the replacement of existing R44 rotor brake switches. The aim of that bulletin was to reduce the chance of the rotor brake switch as a possible ignition source in the event of a fuel leak.

Although the circumstances of this accident are still under investigation, the Australian Transport Safety Bureau has, in the interest of transport safety, issued a Safety Advisory Notice suggesting

that operators and owners of R44 helicopters fitted with all-aluminium fuel tanks actively consider replacing those tanks with bladder-type fuel tanks, as detailed in SB 78A as soon as possible. The existence and content of SB 82 is also highlighted.

The investigation is continuing.

FACTUAL INFORMATION

The information contained in this preliminary report is derived from initial investigation of the occurrence. Readers are cautioned that there is the possibility that new information may become available that alters the circumstances as depicted in the report.

History of the flight

On 4 February 2012, a Robinson Helicopter Company R44 Raven II helicopter, registered VH-COK, was flown to Jaspers Brush Aerodrome, New South Wales (NSW) in preparation for an aerial filming flight (Figure 1). The right rear door and some non-essential equipment were removed from the helicopter in preparation for the filming task. The pilot and camera operator then conducted a short flight at Jaspers Brush to prepare for the filming later that day.

Figure 1: VH-COK



The purpose of the filming flight was to record the launching of a submersible vehicle from a ship in Jervis Bay, NSW about 26 km from Jaspers Brush, for a television documentary. The flight was being conducted as a private operation under the visual flight rules (VFR).¹

At about 1550 Eastern Daylight-saving Time², personnel on the ship informed the pilot that preparations had been completed and filming could commence. The pilot and camera operator boarded the helicopter, with the pilot in the right front seat and the camera operator, who was holding a portable camera, in the right rear seat. The pilot commenced the takeoff at about 1555.

Jaspers Brush Aerodrome is primarily used as a recreational training facility and a number of flight instructors and students observed the takeoff. One of the witnesses also video recorded the event.

Analysis of the video recording showed that the helicopter lifted off and turned left onto what appeared to be a heading for Jervis Bay. During this turn, the pilot's door opened. The helicopter reached a maximum height of about 10 ft.

About 5 seconds after lift off, the helicopter abruptly pitched nose-up then 'slid' backwards before the tailskid struck the ground. The helicopter abruptly pitched forward into a nose-down attitude and rolled to the right before the main rotor blades struck the ground.

After this point, the recording of the accident was incomplete as the witness rapidly moved away from the helicopter. However, some of the recording showed that a fuel-fed fire had started in the vicinity of the fuel tanks and lower main rotor mast area prior to the fuselage hitting the ground at a relatively low speed. There was no indication of fire prior to the rotor blades impacting the ground.

Consistent with several witness reports, the video recording provided no indication of any abnormal engine sounds prior to impact. There was no

indication that the aircraft hit, or was struck by anything prior to the initial pitch nose-up.

Witnesses reported that the fire rapidly engulfed the fuselage. They attempted to put out the fire with the available fire extinguishers but, because of the size and intensity of the fire, they were unable to reach the occupants. Both occupants were fatally injured and the helicopter was destroyed.

Personnel information

The pilot held an Australian Commercial Pilot (Helicopter) Licence that was issued by the Civil Aviation Safety Authority (CASA) in 1999. He was endorsed on the R44 helicopter type and had over 1,800 hours total flying experience.

The pilot held a current Class 1 Aviation Medical Certificate. His last aviation medical examination was conducted on 5 January 2012 and no problems were noted.

Aircraft information

General information

The R44 is a four-seat, single main and tailrotor helicopter that is powered by a six-cylinder piston engine, and equipped with skid-type landing gear. At the time of the accident, there were 457 R44 helicopters registered in Australia.

The helicopter, serial number 10421, was manufactured in the United States (US) in 2004. It was first registered in Australia on 28 July 2004, and had accumulated about 1,300 hours total time in service at the time of the accident.

The pilot and another person owned the helicopter and both used it for private flights. When not required by the owners, an operator based at Bankstown Airport, NSW used the helicopter for charter operations. It was certified for those operations under the VFR.

Airworthiness and maintenance

Preliminary examination of the helicopter's maintenance records indicated that it was maintained in accordance with the engine and helicopter manufacturers' requirements.

The helicopter's last 100-hourly servicing was completed on 9 September 2011. As part of that servicing, the hydraulic servos were repaired and

1 Visual flight rules (VFR) are a set of regulations that allow a pilot to only operate an aircraft in weather conditions generally clear enough to allow the pilot to see where the aircraft is going.

2 Eastern Daylight-saving Time was Coordinated Universal Time (UTC) + 11 hours.

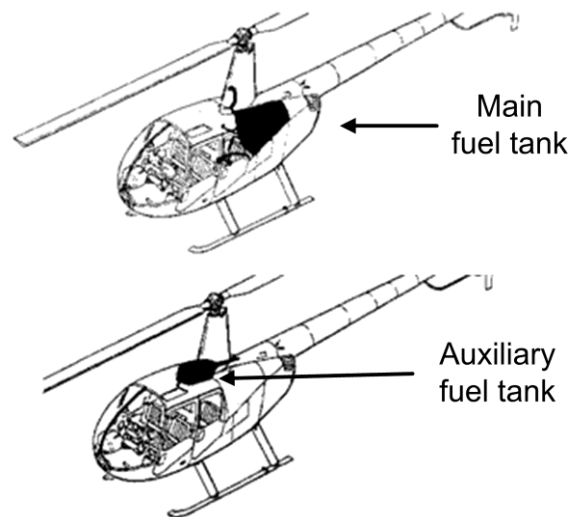
reinstalled. Two rubber engine mounts were also replaced.

The last scheduled maintenance was a 50-hourly inspection that was completed on 6 January 2012. During this inspection, no major defects were identified or required rectification.

Fuel system

The R44 was originally manufactured with two all-aluminium fuel tanks that were installed above the engine firewall, either side of the main transmission (Figure 2). That was the case with VH-COK at the time of the accident.

Figure 2: Fuel tanks



On 20 December 2010, the manufacturer issued R44 Service Bulletin 78 (SB 78) requiring that R44 helicopters with all-aluminium fuel tanks be retrofitted with bladder-type tanks as soon as practical, but no later than 31 December 2014. The background information to the service bulletin stated:

To improve the R44 fuel system's resistance to a post accident fuel leak, this retrofit must be performed as soon as possible.

The manufacturer advised that the bladder-type fuel tanks provided improved resistance to post-accident fuel leaks. That improvement was due to their improved cut and tear resistance and the ability of the bladders to sustain large deformations without rupture. SB 78 also incorporated the fitment of:

- reinforced fuel filler caps, to increase their ability to retain fuel under internal pressure loads

- rollover vent valves, designed to minimise fuel spillage should the helicopter come to rest at an attitude that permitted fuel to reach a fuel tank vent opening.

Prior to the issue of SB 78, the manufacturer had issued service bulletins 67, 68 and 69 (SB 67, SB 68 and SB 69) that were similarly designed to reduce the likelihood of post-accident fuel leaks. SB 67 and SB 68 involved modifications that increased the allowable movement of the fuel lines during an accident. SB 69 detailed a modification that was designed to improve retention of the gascolator³ sediment bowl under impact loads.⁴

The helicopter had been modified to include SB 67, SB 68 and SB 69. The bladder-type fuel tank retrofit detailed in SB 78 had not been incorporated. There was no Airworthiness Directive issued by either the US Federal Aviation Administration or by CASA mandating the fitment of the bladder-type tanks.

The helicopter manufacturer advised that about 4,000 helicopters were initially manufactured with the all-aluminium tanks and about 400 SB 78 retrofit kits had been shipped worldwide. In other words, about 10% of R44 helicopters that were initially fitted with all-aluminium tanks had been retrofitted with the bladder-type tanks.

The manufacturer also advised that it was aware of four accidents involving R44 helicopters fitted with bladder-type tanks. Those accidents were of sufficient severity to result in fatal or serious injury to the occupants. Whereas the manufacturer advised that three of these accidents did not result in a post-accident fire, at the time of writing, the manufacturer was unable to confirm whether a post-accident fire occurred in the fourth instance.

The Australian Transport Safety Bureau (ATSB) is also investigating an accident involving an R44 with all-aluminium fuel tanks that occurred at Cessnock, NSW on 4 February 2011. The occupants of that helicopter survived the initial

³ Fuel filter fitted at the lowest point of the fuel system.

⁴ In 2006, the helicopter manufacturer issued Safety Notice SN-40 that strongly recommended all occupants of its helicopters wear fire-retardant flight suits, gloves and hoods or helmets in case of fire.

impact with the ground but did not survive the post-accident fire.⁵

Meteorological information

Witnesses reported that the weather conditions at Jaspers Brush at the time were fine, with high cloud and a slight easterly breeze. The video recording was consistent with those reports.

Wreckage and impact information

The wreckage was located on a grassed area of the aerodrome about 12 m from the nearest structure (Figure 3). All of the helicopter's major components were identified at the accident site (Figure 4).

Figure 3: Accident site



Figure 4: Helicopter wreckage



Much of the wreckage was consumed by a post-impact, fuel-fed fire. There was no evidence of an in-flight fire.

The main fuel tank was destroyed by the fire and the main rotor gearbox, which was located adjacent to the main fuel tank at manufacture, was displaced from three of its four mounting points. There were holes in the side of auxiliary

fuel tank closest to the main rotor gearbox (inboard tank wall) that appeared to have been a result of the fire. There was superficial damage only to the corresponding outer wall of the tank. About 20 L of fuel was recovered from the auxiliary tank.

Most of the alloy flight control tubes had been burned away during the post-impact fire, precluding a full examination of the flight control system. Examination of the helicopter's main and tailrotor flight control connections, engine control connections, main and tailrotor drive and its fuselage structure revealed no evidence of any pre-existing anomalies.

Several components were recovered from the accident site for technical examination. These included the remains of the pilot's door and the main rotor hydraulic servos.

After the accident, a relatively-large patch of dead grass developed at a point thought to be the helicopter's point of lift off. A sample of soil from that area was obtained for further examination.

FURTHER INVESTIGATION

The investigation is continuing and will include:

- examination of the helicopter's maintenance and airworthiness records
- examination of the recovered components
- testing of soil samples taken from the scene
- analysis of witness statements and the conduct of further interviews as required
- detailed analysis of the video recording of the accident
- a review of the pilot's experience and medical status
- a review of previous R44 accidents in Australia that involved post-impact fires.

5 ATSB investigation AO-2011-016, available at www.atsb.gov.au/publications/investigation_reports/2011/aair/ao-2011-016.aspx

SAFETY ACTION

ATSB safety advisory notice AO-2012-021-SAN-001

Robinson Helicopter Company

On 21 February 2012, the helicopter manufacturer released Service Bulletin (SB) 78A that brought forward the date of compliance as stated in SB 78 from 31 December 2014 to 31 December 2013.⁶

In conjunction with the United States Federal Aviation Administration, the manufacturer is also examining other methods to ensure greater compliance with that upgrade while taking into account the rate at which the bladder-type fuel tanks, and the other associated components, are able to be manufactured. The issue of an Airworthiness Directive is being considered.

On 21 February 2012, the manufacturer also released SB 82 that required the replacement of the rotor brake switch to reduce the chance of a possible ignition source in the event of a fuel leak.⁷ The stated time of compliance was 'within the next 150 flight hours or by 31 May 2012, whichever occurs first'.

Australian Transport Safety Bureau

The Australian Transport Safety Bureau (ATSB) generally proposes corrective or precautionary action in response to an occurrence only where it is justifiable on the basis of established or probable facts. Although work remains to be done to establish the facts of this accident fully, the circumstances are consistent with the consequences of the accident being significantly exacerbated by the fuel-fed fire.

The ATSB therefore draws the attention of all R44 operators to the following advisory notice, on the basis of prudence, until such time that the mechanism(s) contributing to the accident are fully established and understood. All R44 operators will receive a copy of this report and advisory notice.

The Australian Transport Safety Bureau encourages all operators and owners of R44 helicopters that are fitted with all-aluminium fuel tanks to note the circumstances of this accident as detailed in this preliminary report. It is suggested that those operators and owners actively consider replacing these tanks with bladder-type fuel tanks as detailed in the manufacturer's Service Bulletin (SB) 78A as soon as possible.

In addition, the ATSB highlights the existence and content of SB 82 that aims to reduce the chance of the rotor brake switch as a possible ignition source in the event of a fuel leak.

⁶ SB 78A applied to R44 models with serial numbers 0001 to 2064, and R44 II models with serial numbers 10,001 to 12,890.

⁷ SB 82 applied to R44 models with serial numbers 0001 to 2126, and R44 II models with serial numbers 10,001 to 13,139.