

Departure from THE NORM

The pilot flew the R44 low and slow on the Western Australia sightseeing flight.

BY LINDA WERFELMAN

The pilot of a Robinson Helicopter R44 Raven had deviated from the regular scenic tour route in a mountainous area of Western Australia and was flying slow and close to the ground when the helicopter crashed, killing the pilot and all three passengers, the Australian Transport Safety Bureau (ATSB) says.

The ATSB, in its final report on the accident, identified the departure from the “regular scenic flight track, speed and profile” as a contributing safety factor in the Sept. 14, 2008, crash.

Other factors were that the “out-of-ground-effect¹ hover performance of the helicopter was likely to have been marginal” and that the “high level of engine power required to sustain a hover in the local conditions either was not available

or was not fully utilized by the pilot, resulting in the sequential development of an uncommanded descent, overpitching,² significant main rotor RPM decay, a high rate of descent and collision with terrain,” the report said.

The accident helicopter was one of four R44s that were flown on sightseeing flights from a sub-base at the Purnululu Aircraft Landing Area (ALA) at the southwestern tip of the Bungle Bungle mountain range in Purnululu National Park, 250 km (135 nm) south of Kununurra, Western Australia.

The morning of the accident, the helicopter was flown by other pilots on three sightseeing flights. At the same time, the accident pilot flew another R44.

Around 1230 local time, the pilot and his three passengers boarded the accident helicopter for what was to be an 18-minute flight. The pilot designated a search and rescue time — SAR-TIME, or the time at which search and rescue was to begin if there was no contact from the pilot — of 1250.

At 1250, when the helicopter had not returned to the ALA, other company pilots tried unsuccessfully to contact the helicopter by radio and then searched in another of the company’s helicopters. The pilot who initiated the search saw smoke northeast of the ALA, and when he flew toward it, he found the wreckage of the accident helicopter.

A digital camera recovered from the wreckage contained images taken by one of the passengers that showed that around 1245, the helicopter left the regular route and traveled south, toward an area of distinctive rock formations.

“The helicopter’s speed and height, as derived from this sequence of images, was

not consistent with the standard scenic flight parameters,” the report said. The last image was taken when the helicopter was about 80 m (262 ft) from a rock face and about 100 ft above the level of the accident site.

R44 Endorsement

The accident pilot received a commercial pilot license in 2002. He flew sporadically for several years, until he began refresher training with the operator in August 2007. That training consisted of flight in an R44, and in operations in confined areas, power limitations, autorotation and “a check of the pilot’s understanding of overpitching.” In January 2008, he received an endorsement for R44s and was certified for satisfactory completion of a flight review.

In May 2008, he began conducting scenic flights in the Bungle Bungle area on a regular basis, and at the time of the accident, he had accumulated 477 flight hours in helicopters, including

346 hours in R44s. He held a Class 1 medical certificate, and there was no indication of any physiological problem that might have contributed to the accident, the report said.

On July 14, 2008, he underwent a standard 180-day flight check, including autorotation, low-level maneuvering and confined-area training, as well as ground training. The report on the flight check noted that “confined areas need[ed] more work,” but there were no details.

The helicopter was manufactured in 2006 in the United States

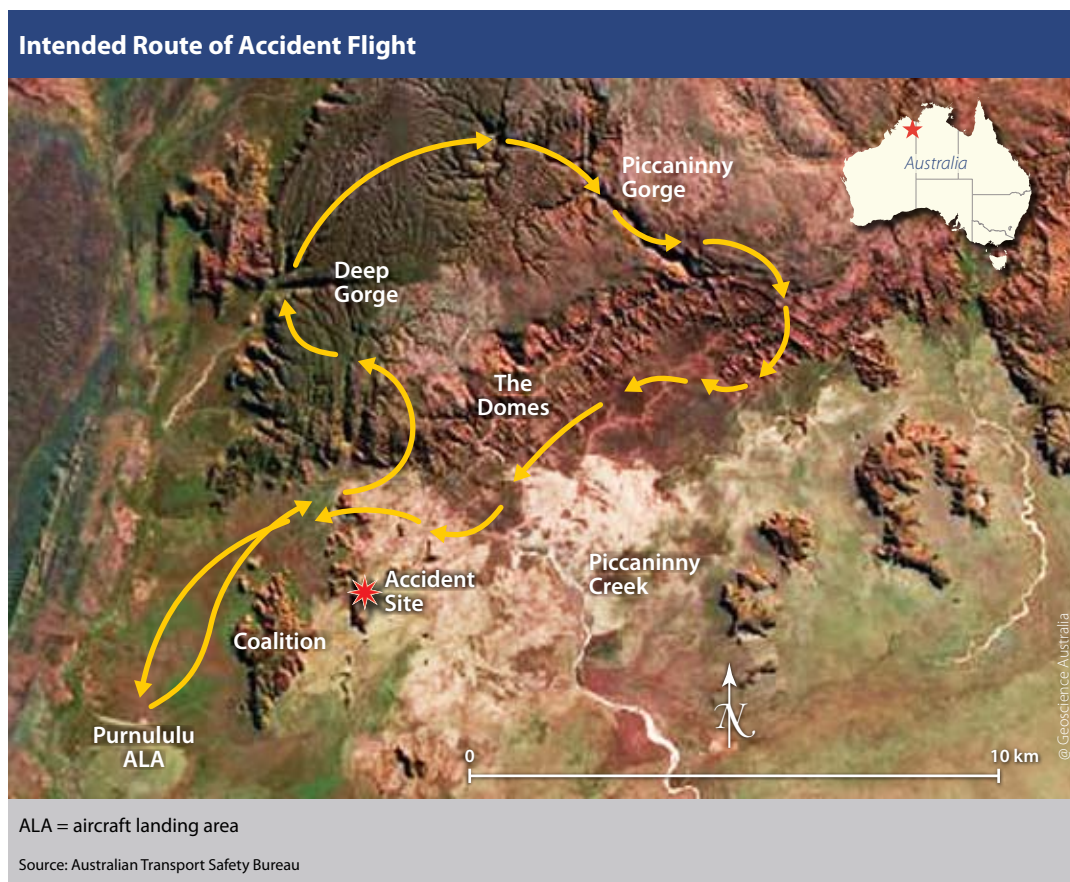


Figure 1

and registered the same year in Australia. Its total time in service was 1,533 hours. The engine — a Lycoming O-540-FIB5 — was new when it was installed at the factory and was top-overhauled at about 823 hours total time.

A 100-hour inspection was conducted Aug. 20, 2008, about 76 hours before the accident, and the last recorded maintenance was performed Aug. 29, when new bearings were installed in the main rotor hub, along with a subsequent adjustment of system components.

The pilot on the flight before the accident flight said that the helicopter had performed well. The helicopter apparently was refueled, with fuel from the operator's fuel storage facility, after that flight, but documentation was not available, the report said.

The helicopter's weight for the accident flight was within limits.

Weather at the accident site was described as hot, cloudless and dry, with light winds. The nearest site for recorded hourly observations was about 100 km (62 mi) to the southwest, where surface winds were from the southwest to southeast at less than 5 kt, with gusts to 10 kt, and the temperature was 35 degrees C (95 degrees F). Moderate thermal turbulence was considered likely below 9,000 ft.

The wreckage was found in a flat site at the base of a rocky, upsloping area. The helicopter was "seriously damaged" by the impact and a subsequent fire, the report said, noting that it had struck the ground upright, with the right skid low and at a high vertical speed but little or no forward speed.

An examination of the engine revealed no anomalies, other than damage from the impact and the fire.

Specific Route

The company operations manual allowed flight at altitudes below 500 ft in specific circumstances — but those circumstances did not include during sightseeing flights over the Bungle Bungles.

"While the operations manual section regarding scenic flights over the Bungle Bungles did not provide specific operational parameters,

a number of pilots stated that they were generally trained to follow a specified route," the report said. "Altitude was varied during flight to maintain a minimum of 500 ft above ground level [AGL] while maintaining about 80 kt indicated airspeed."

The operator said that pilots who flew over the Bungle Bungles were "selected, trained and checked to the standard required to safely conduct those flights."

Another section of the operations manual discussed aerial photography, describing it as an "extremely demanding" operation and noting that a pilot engaged in such a mission should have a "thorough understanding of the limitations of the helicopter when operating out of ground effect at high gross weights, low indicated airspeeds and out of wind."

Australian Civil Aviation Safety Authority (CASA) standards, outlined in the *Day VFR Syllabus — Helicopters*, do not discuss the risks of an out-of-ground-effect (OGE) hover, or of avoiding, and recovering from, low-rotor RPM. Nevertheless, the aeronautical knowledge syllabus says pilots should understand the power available/power required curves, as well as over-pitching. The flight training syllabus includes "avoidance of the manufacturer's height velocity (H-V) diagram avoid area in hovering flight"; confirmation of helicopter performance, including power checks as applicable, when landing in a confined area; [and] execution of limited power takeoff, approach and landing."

Neither the *Flight Instructor's Manual — Helicopter*, published by CASA and the Civil Aviation Authority of New Zealand, nor the civil aviation advisory publication about flight reviews presented specific guidance about OGE hover, the report said.

Pilot Survey

As part of the accident investigation, eight experienced helicopter pilots were questioned about their understanding of slow OGE flight.

"Overall," the report said, "the participants did not perceive that there were significant deficiencies in the generic pre-license training

Pilots who flew over the Bungle Bungles were 'selected, trained and checked to the standard required to safely conduct those flights.'

requirements. There was general agreement ... that pre-license training was ‘basic training’ and was conducted in a relatively benign environment that was inherently limited in its capacity to prepare pilots for all possible helicopter operating environments. ...

“There was also general agreement that the Robinson R22 and R44 helicopters, with their relatively low inertia rotor system, engine governor, throttle correlation system and derated engines, were different [from] other piston-engine helicopters. It was reported that pilots flying the R22 and R44 were not always aware of the applicable engine power limits and did not always adhere to those limits.”

‘Most Likely Scenario’

Investigators were unable to determine whether the engine was rotating at impact but concluded that the unsuitability of the accident site for landing after an engine failure, along with the availability of more suitable sites nearby, indicate that if there had been an engine failure, it “had not occurred from the cruise height and speed applicable to the anticipated scenic flight profile.”

The report said it was most likely that, “at slow speed or the hover, the engine power required exceeded the engine power available or selected, with a consequent descent. The pilot probably responded instinctively by raising the collective lever, which further increased main rotor drag and therefore the power required, leading to main rotor RPM decay (overpitching), a low rotor RPM warning and an increased descent rate.”

By departing from the usual scenic flight profile, the pilot “negated the operator’s risk control for those flights not to be conducted below 500 ft above ground level,” the report said, adding that, by slowing to an OGE hover, the

pilot “committed to a more difficult maneuver than that intended by the operator for the scenic flight. Had the operator been aware of the pilot’s intent, the informal requirement for the senior pilot at the operator’s Kununurra base to be involved in the tasking of a suitable pilot may have meant that the flight did not occur or that a different pilot was involved.”

The report noted that the U.S. Federal Aviation Administration (FAA) has ordered additional pilot knowledge and safety training requirements for pilots of R22s and R44s, specifically to address the “insidious and critical nature” of low main-rotor RPM; when the report was written, no such requirements existed for flight training in Australia.

Safety Actions

On Sept. 19, 2008, five days after the accident, the operator’s chief executive officer issued a memo to remind pilots of the company’s policy about authorization of flights and that “it was unnecessary to operate any helicopter within the height-velocity avoid area during routine charter and scenic flights,” the report said. They also were told not to operate below 50 kt while flying in cruise below 1,000 ft AGL on sightseeing flights, and not to deviate from published scenic flight paths, except in an emergency or “as deemed necessary by the pilot-in-command.” Any deviation under those circumstances was to be reported to the chief pilot.

The operator also ordered check flights with all pilots before the start of each tourist season, along with follow-up check flights; took steps intended to ensure that pilots were aware of Robinson Helicopter Co. Safety Notice SN-34, which discussed the hazards of low, slow flight; and established a Web-based

safety-reporting system for communicating operational requirements.

CASA said after the accident that it would review initial and recurrent pilot training requirements — action that the ATSB said “could be expected ... [to] address the safety issue” identified in the accident report.

The ATSB also issued Safety Advisory Notice SAN AO-2008-062-SAN-098 to draw operators’ attention to “the potential lack of assurance that informal operator supervisory and experience-based policy, procedures and practices minimize the risk of their pilots operating outside the individual pilot’s level of competence. Operators are encouraged to consider the safety implications of this safety issue and take action where considered appropriate.”

This report is based on ATSB Transport Safety Report AO-2008-062, Collision With Terrain, 6 km NE of Purnululu ALA, Western Australia, 14 September 2008, VH-RIO, Robinson Helicopter Company R44 Raven.

Notes

1. Flight in ground effect usually occurs when a helicopter is less than one rotor diameter above the surface, the ATSB report said, citing the FAA’s *Rotorcraft Flying Handbook*. At this height, helicopters require less power to hover because of “the cushioning effect created by the main rotor downwash striking the ground.” Operations conducted above that height are said to be “out of ground effect.” In an R44, the rotor diameter is 33 ft (10 m).
2. The report describes “overpitching” this way:

If a pilot selects a high collective setting that, in the prevailing conditions, produces rotor drag greater than the available engine power, the main rotor RPM will decrease below the governed RPM of between 101 and 102 percent. That situation is termed overpitching, and can develop into a critical condition known as blade stall.