The NTSB says intensified efforts are needed to find the cause of incidents of severe vibration in R44s.

BY LINDA WERFELMAN

The U.S. National Transportation Safety Board (NTSB), citing a 2009 accident involving severe vibration known as “mast rocking” in a Robinson R44, says the manufacturer should be required to identify the cause of the phenomenon and develop steps to avoid it.

Robinson Helicopter told NTSB accident investigators that, even before the agency issued its recommendations, it has begun flight tests to evaluate the problem, sometimes called “chugging.”

The pilot of the accident helicopter — operated by the state of Alaska and being flown in visual meteorological conditions on May 12, 2009, by the Alaska State Troopers–Fish and Wildlife Protection on a game-management patrol — said that about 90 seconds after departure from a site 57 nm (106 km) northwest of Iliamna, Alaska, he felt an unusual vibration, mostly in the pedals, followed by a slight yaw.

“The pilot said the vibrations became oscillations, in both yaw and pitch, to the point he felt the helicopter was going to come apart,” the NTSB said in a safety recommendation letter to the U.S. Federal Aviation Administration (FAA). “He said an emergency landing was his only option.”

The pilot said he “fought to maintain control” of the helicopter during the emergency landing, and the helicopter touched down with a forward airspeed of 5 to 10 kt. The main rotor blades contacted the tail boom during the hard landing, causing substantial
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problem during production flight test and ... had not received any further reports of vibration incidents from in-service aircraft.”

As a result, the manufacturer had no plans to issue a service letter, the AAIB added, “although this situation would be reconsidered if new reports of vibration were received.”

The NTSB safety recommendation letter cited two events involving mast rocking, including one that occurred after the manufacturer’s statement to the AAIB:

- On March 15, 2007, an R44 pilot conducted an emergency autorotative landing in Miami after experiencing a “huge vibration.” Neither of the two people in the helicopter was injured, but the helicopter was substantially damaged. The NTSB said the probable cause of the accident was “the pilot’s failure to maintain sufficient rotor rpm during an autorotative landing, which resulted in a hard landing and separation of the tail boom.”

- On Sept. 30, 2007, the pilot of another R44 conducted an emergency landing in a cornfield near Jackson Center, Ohio, U.S., after he experienced a severe vibration during approach to the landing zone. The pilot — the only person in the helicopter — was not injured, but the helicopter was substantially damaged when the tail rotor struck tall corn and the tail rotor gearbox separated. The NTSB cited as the probable cause “the reported vibration in the helicopter during an approach for landing.”

The NTSB safety recommendation letter cited a December 2006 report by an FAA flight test engineer who had participated in Robinson’s flight tests and who noted that mast rocking had been induced “in various flight regimes and stopped under certain conditions using an R44 with aft and forward main rotor transmission mounts designed to react with upward and downward movement of the transmission.”

The FAA test pilot’s report noted that some combinations of transmission mounts and vibration isolators precluded mast rocking. Nevertheless, the manufacturer and the FAA test pilot agreed that each helicopter behaved differently during testing, so “no standard configuration was established,” the NTSB said.

The NTSB added, “The lack of a specific solution for the mast-rocking vibration in all affected R44 helicopters suggests that the manufacturer has not identified the underlying cause of the vibration.”

The agency recommended that the FAA “require Robinson Helicopter to resolve the root cause of the mast-rocking vibration in the main rotor assembly to ensure that all applicable R44 helicopters are free of excessive vibrations in all flight regimes.”

Other recommendations called on the FAA to require the manufacturer to maintain a database of reported mast-rocking events in R44s, to add information to the R44 flight manual to inform pilots of the potential for mast rocking and to require that the R44 pilot training program be revised to include instruction in the recognition and mitigation of mast rocking vibrations in the main rotor assembly.

A final recommendation said the FAA should “issue a service letter to all approved service centers describing the mast-rocking vibration that can occur in the main rotor assembly” of R44s and “instructing service centers to report all incidents of mast rocking to the manufacturer.”

**Notes**


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**Robinson R44**

The Robinson R44 is a four-seat light helicopter developed in the late 1980s and first flown in 1990. It incorporates some elements of the two-seat R22 — including a tri-hinge underslung rotor head designed to limit blade-flexing and rotor vibration — but has a larger cabin.

The R44 has one Textron Lycoming O-540 six-cylinder reciprocating engine. Its empty weight is 1,442 lb (654 kg) and maximum takeoff and landing weight is 2,400 lb (1,089 kg). Standard fuel capacity is 31 U.S. gal (116 L).

Cruising speed at maximum takeoff weight and 75 percent power is 113 kt. Maximum rate of climb at sea level is 1,000 fpm. Service ceiling is 14,000 ft, hovering ceiling in ground effect is 6,100 ft, and hovering ceiling out of ground effect is 4,500 ft. Maximum range, with no fuel reserve, is about 347 nm (643 km).

Source: Jane’s All the World’s Aircraft