

# NATIONAL TRANSPORTATION SAFETY BOARD WASHINGTON, D.C.

ISSUED: April 23, 1980

Forwarded to:

Honorable Langhorne M. Bond  
Administrator  
Federal Aviation Administration  
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-80-30 and -31

During several recent accident investigations, the Safety Board has identified recurring failures of tail rotor blades on Bell model 47 helicopters. Two recent accidents in California are typical of several previous accidents.

On March 8, 1980, a Bell 47G helicopter crashed during a crop dusting operation in Brentwood. The pilot was seriously injured. The investigation is continuing; however, preliminary reports indicate that a tail rotor blade separated in flight.

On September 14, 1979, a Bell 47J-2 helicopter lifted off the Queen Mary helicopter pad with four passengers and a pilot on board for a sightseeing tour of Long Beach Harbor. Witnesses saw the tail rotor blade separate from the aircraft at 200 feet above ground level and in level flight over Queensway Bay. The helicopter descended out of control, crashed, and sank in 35 feet of water. All five occupants were killed.

Upon examination, the tail rotor blade, P/N 47-642-102, was found to have separated through the grip in the grease seal radius retention area. This area is covered by Airworthiness Directive 70-10-08. The Airworthiness Directive requires a detail daily inspection of the exterior surface of the blades for the presence of cracks, dents, and nicks, and a 150-hour periodic inspection of the interior surface of the blade in the grip area for cracks, corrosion, and tool marks. The inspection is to be conducted using dye penetrant techniques, or a light and a magnification device.

A metallurgical examination of the failed blade disclosed that the failure stemmed from a fatigue crack that began on the inside diameter of the grip. The fatigue had begun at small corrosion pits less than 0.002-inch deep. The service life of the blade is 600 hours; however, this blade failed within a total time of only 536.4 hours.

Additional recent accidents involving tail rotor blade failures on Bell 47 series helicopters include the following:

- (1) A Bell 47G-2A-1 helicopter, N1158W, crashed 3 miles NW of Laughmar, Florida, on July 15, 1978. There was one fatality. The tail rotor blade, P/N 47-642-102, separated because of a fatigue crack that had begun on the trailing edge of the airfoil. The total time on the blade was 77.5 hours.
- (2) A Bell 47G-2 helicopter, N47WV, crashed at Pigeon Forge, Tennessee, on July 16, 1978, resulting in four fatalities. The tail rotor blade, P/N 47-642-102, separated because of a fatigue crack that started in the grip. The total time on the blade was 468 hours.
- (3) A Bell 47G-2 helicopter, N68367, crashed in Solodad, California, on August 12, 1978. The tail rotor blade, P/N 47-642-102, separated because of a fatigue crack that began in the grip. The total time on the blade was 400 hours.
- (4) A Bell 47G-2, N6729D, crashed near Crossland, Georgia, on August 12, 1978. The tail rotor blade, P/N 47-642-102, separated because of a fatigue crack that began in the grip. The total time on the blade was 365 hours.

In most of the failures examined by the Safety Board's Metallurgical Laboratory, the fatigue cracks had begun from extremely small stress raisers such as knicks, corrosion pits, tool marks, and scratches. Most of these defects could have been overlooked by a visual inspection.

The long history of fatigue failures in tail rotor blade P/N 47-642-102 reflects a low fatigue margin and an obvious need to replace the blade with a design more resistant to fatigue cracking.

In December 1979, Bell issued Alert Service Bulletins Nos. 47-79-3 and 47-79-4, which recommended that the service life of the tail rotor blades be reduced immediately from 600 hours to 300 hours, and that all blades with more than 300 hours be scrapped. The Bulletins further recommended that the current model blades be replaced with the new model blades by July 1980. The new model blades have been shown to have a higher margin for fatigue and have a higher recommended service life of 2,400 hours.

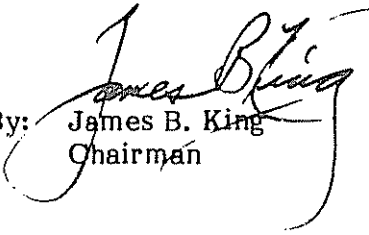
The FAA's Southwest Region has issued a Notice of Proposed Rulemaking (NPRM) for adoption of an Airworthiness Directive on this matter, which essentially is the same as the Bell Service Bulletins except that the NPRM excludes those Bell 47 helicopters equipped with Franklin (Aircooled Motors) engines. In the text of the NPRM, the FAA recognizes the need for the improved tail rotor blades to be installed on these models and recommends that this be accomplished later. The Safety Board does not agree that the Bell 47 helicopters equipped with these engines should be excluded from the provisions of the proposed Airworthiness Directive. Further, the Safety Board believes that removal of all blades with part No. 47-642-102 should be expedited.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

Issue an Airworthiness Directive to require the installation of the improved tail rotor blades, part No. 47-642-117 on all Bell 47 model helicopters for which the installation has been approved as soon as possible after receipt of the directive. (Class I, Urgent Action) (A-80-30)

Expedite the approval of the improved tail rotor blades for installation on all Bell 47 model helicopters equipped with Franklin engines and expedite action to require the installation of the improved blades on those aircraft. (Class I, Urgent Action) (A-80-31)

KING, Chairman, DRIVER, Vice Chairman, McADAMS and GOLDMAN, Members, concurred in these recommendations. BURSLEY, Member, did not participate.

By:   
James B. King  
Chairman