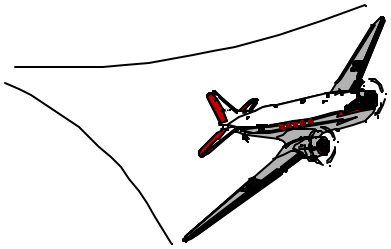
SPECIAL AIRWORTHINESS INFORMATION BULLETIN



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Introduction

The intent of this bulletin is to provide facts and background information on the decisions that resulted in the recent airworthiness directive (AD-2000-18-51) on the Bell Model 47 helicopter main rotor grips. Ongoing and anticipated future actions will also be discussed. Most of the information provided below was explained in detail during a January 29-30, 2001 meeting between the FAA Rotorcraft Directorate, the National Transportation Safety Board (NTSB), the Experimental Aircraft Association (EAA), the Helicopter Association International (HAI), the Aircraft Owners and Pilots Association (AOPA), and Bell Helicopter Textron. An effort is also made to answer the most common questions and comments that owner/operators sent to the AD docket file. Note that this information bulletin does not change any AD requirements that are presently in force.

Background

There have been four accidents resulting from main rotor grip failures since the certification of the Model 47. All of the failures can be traced to cracks originating in the grip threads. The first two accidents occurred in the United States in 1971 and 1972. One resulted in a fatality. An AD was issued in 1973 as a result. The third accident occurred in Australia in 1985. The Australian government subsequently conducted a study of grips from Australian operators using eddy current inspection techniques. Cracks were discovered in 60 percent of that sample. Flight time ranged from a low of 1996 hours to a high of 5000 hours. The Australian report concluded that the “fatigue cracking problem is significant and widespread”. As the aviation authority of original type certification, the FAA considers worldwide service difficulty information when making continued operational safety decisions. Bell and the FAA reviewed the Australian data along with existing U.S. crack data and internal Bell engineering data. Bell subsequently issued a service bulletin stating that the grips should be retired at 1200 hours versus the original 2500 hours for wood blade grips and 5000 hours for metal blade grips. Considering that all the failures occurred at more than 1200 hours, and in consideration of the expected hardship on operators if the service life on the grip was reduced, the FAA issued an AD in 1986 that left the life limit on the part at 2500/5000 hours, but imposed a recurrent inspection cycle. The 1986 AD required dye penetrant inspection.

In 1998 a fourth accident occurred in Canada as a result of blade grip failure. According to the available records, the parts were very low time (approximately 200 hours). The FAA obtained a copy of a Canadian laboratory report, which cited cracking in the threads on both grips. Given the very low time on these parts, the FAA made a conscious decision to wait for more definitive information from Transport Canada regarding the records on these parts. In the interim, the FAA and Bell began another detailed review of service difficulty reports and field service data. Some 70 cracked grips had been formally reported since original type certification of the Model 47.

The Bell model 47 main rotor blade grips were originally designed and qualified as “safe life” parts. During the certification testing the fatigue strength of the grip was established by cycling several parts to failure in a laboratory test rig. The time of failure was then subjected to a “knockdown factor”. A typical knockdown factor for a critical part is at least four. So, if the grip theoretically failed at 20,000 hours on the test rig, the field service life would be set at approximately 5,000 hours, or less. It is important to understand that the underlying premise of safe life assumes that the part will not fail within its published life limit. Following the 1985 failure and with evidence from the 1986 analysis that grips were cracking, Bell correctly reduced the safe life on the part. In its efforts to soften the impact on operators, the FAA introduced recurring inspections that in effect replaced safe life with dye penetrant inspections. The part apparently does have a degree of damage tolerance, and the FAA believed that inspections would detect a crack before it reached critical dimension and failed. Unfortunately, we do not know how damage tolerant the part is because a crack growth analysis was never done. The FAA recently asked Bell to conduct a crack growth test on a grip that is known to have a crack at 1196 hours time in service. It is noteworthy that the crack in this particular grip was missed by a dye penetrant inspection and later discovered using eddy current.

Initially the FAA had some questions regarding the records for the grips involved in the 1998 Canadian accident. Inquiries were made to Transport Canada and in June 2000 Transport Canada notified the FAA that the log book records for the 1998 accident aircraft appeared to be accurate. In October of 2000 the Transportation Safety Board of Canada issued a report that stated, in part, that “the helicopter was certified, equipped, and maintained in accordance with existing regulations and approved procedures”. Considering this accident, the lack of crack growth data on the grips, and the growing body of evidence that these 2500/5000 hour “safe life” parts continue to develop cracks, in a number of cases at less than 1200 hours, the FAA issued AD 2000-18-51. A recent operator survey conducted by the EAA indicates that a grip was found with a crack of nearly two inches in length as a result of the AD. The operator commented that the AD “saved my life”.

Operators have asked if there is a trend in the data that might isolate cracked grips to a specific type of operation, vendor, production lot, or type of rotor blade. Unfortunately, there is no discernable trend. Speculation that the parts are only failing in Australia or Canada is not supported by the data, either before or after the AD.

The interim inspections required by the AD are intended to deal with the documented instances of grips cracking at less than 1200 hours. In order to help mitigate the inspection requirement, the FAA has asked Bell to conduct crack growth testing. The testing could show that if a crack were to start prior to the 1200 hour life limit, the crack would not grow to a critical length (failure) prior to part retirement. Conversely, it could show less desirable results. Testing will be completed in October 2001 but interim results will be available in the June timeframe.

Dye penetrant inspection of the thread area has not been totally effective. Eddy current inspection has been found to be more reliable in detecting cracks in threads. The fine threads in the grip and the limited inspection area combine to reduce the effectiveness of dye penetrant. There have been a number of instances where cracks not discovered by dye penetrant were detected by eddy current. The FAA is considering revising the AD in the near future to require eddy current inspection. Prior to revising the AD, an eddy current inspection procedure that can be conducted in the field will be developed.

Another concern is parts availability. Although grossly underestimating the parts shortage when issuing the most recent AD, the FAA took immediate action when the scope of the problem became apparent. Alternate method of compliance (AMOC) authorizations were issued to AD 2000-18-51 extending the service life of the part from 1200 to 2500 hours with additional recurring inspections. The lack of engineering analysis combined with known crack/failure data does not support extending

the life limit beyond that permitted by the current AMOC. Part availability remains limited due to the amount of special tooling that is presently available to manufacture the grip. Bell is looking at ways to provide more tooling to increase production. "Original design" grips should begin to enter the supply system in late March. Additionally, there is a possibility that Parts Manufacturer Approval (PMA) grips might supplement Bell's production. The new "original design" parts will be subject to AD action until results of crack growth testing are available. Improved grip and adapter nuts are tentatively planned for production release by late summer. Bell is not seeking a life limit extension for the improved parts but anticipates that process changes combined with crack growth testing will convince the FAA to eliminate recurring inspections. The improved grip and adapter nut will have new part numbers.

The FAA tentatively plans to revise AD 2000-18-51, probably with a superceding action. Actions that were proposed by the FAA and tentatively agreed upon by the participants at the January 29-30, 2000 meeting include the following:

1. Eddy current should be the required inspection method in the superceding AD.
2. Operators should be encouraged to perform an eddy current inspection as soon as possible even though time credit may be given for a dye penetrant inspection that was conducted under the original AD.
3. The AMOC retirement life of 2500 hours should be retained until parts supply meets demand. At that point the life of the part should be reduced to 1200 hours. (Bell Helicopter recommends all grips be retired at 1200 hours).
4. The FAA will revisit the 1998 Canadian accident by contacting Bell and the Canadian authorities. Additional documented information that has a bearing on this issue will be considered during future actions.
5. The FAA will consider any additional data that might support changing the inspection interval to 300 hours.
6. The superceding AD will require reporting of cracked grips to the FAA.
7. The FAA and industry groups will assemble a list of NDI inspection facilities that can perform the new eddy current inspections.

The FAA hopes that this information provides some additional background for the Bell 47 operators. Progress reports are planned as new information becomes available. Rotorcraft Directorate representatives will be at the HAI Heli-Expo, and tentatively plan to be at the EAA AirVenture 2001 in Oshkosh to address concerns directly with operators.

For Further Information Contact

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