

Log # 2656



National Transportation Safety Board
Washington, D.C. 20594

Safety Recommendation

Date: SEP - 8 1997

In reply refer to: A-97-99 through -101

Honorable Jane F. Garvey
Administrator
Federal Aviation Administration
Washington, D.C. 20591

On March 21, 1996, a Bell Helicopter Textron, Inc. (BHTI), 205A-1 helicopter, N68HJ, crashed while conducting an external lift operation at Grove Hill, Alabama, after its vertical fin separated from the tail boom just above the intersection of the vertical fin spar and tail boom.¹ The aircraft was substantially damaged but the pilot was not injured. Examination of the separated pieces of the tail boom at the Safety Board's materials laboratory revealed that the vertical fin separated from the tail boom as a result of fatigue cracking in the left cap of the vertical fin front spar. The fatigue cracking initiated from the first rivet hole above the top of the tail boom. The left side of the vertical fin is normally subject to tensile loading as a result of anti-torque forces produced by the tail rotor. The Safety Board determined the probable cause of that accident to be "fatigue failure of the vertical fin forward spar in an area that was not accessible to inspection," and also stated that guidance for inspection of the area where the fatigue occurred was insufficiently defined by the manufacturer.

On August 12, 1996, near Coeur d'Alene, Idaho, a Garlick UH-1H helicopter, N97NW, also experienced a separation of its vertical fin while hovering shortly after releasing an external load during logging operations.² The helicopter subsequently entered an uncontrolled rotation and crashed. The aircraft was substantially damaged and the commercial pilot, its sole occupant, was seriously injured.

N97NW was originally manufactured by BHTI in 1966 as a military UH-1D, and was subsequently modified to UH-1H model specification (the model from which the commercial 205A-1 was developed) by the U.S. military. It received Federal Aviation Administration (FAA) civil airworthiness certification in August 1994 as a restricted-category aircraft under Garlick's FAA type certificate H13WE. The operator reported the airframe total time as 8,762.4 hours. Review of the aircraft maintenance records indicated compliance with all required inspections,

¹ NTSB accident ATL96LA068.

² NTSB accident SEA96FA187.

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including FAA Airworthiness Directive (AD) 83-03-03, which mandates visual and x-ray inspections of certain areas of the tail boom at specified intervals. AD 83-03-03, however, does not direct inspections of the area where the fracture occurred.

The fractured vertical fin spar from N97NW was sent to BHTI's field investigation laboratory in Fort Worth, Texas, for metallurgical examination under the supervision of the Safety Board's South Central Regional Office, Arlington, Texas. BHTI's laboratory examination of the fracture surfaces revealed that the vertical fin fractured in a similar manner and at a similar location to the vertical fin from the Grove Hill (N68HJ) accident, with fatigue cracking in the left cap of the vertical fin front spar.

On November 5, 1996, a Garlick TH-1L helicopter, N465JR, also engaged in logging operations, was destroyed in a collision with terrain following a loss of control while in a hover near Leavenworth, Washington.³ The tail rotor system and vertical stabilizer separated from the aircraft in flight, and the commercial pilot of that aircraft was fatally injured.

As with N97NW, N465JR was originally manufactured by BHTI in 1970 as a military TH-1L (a variant of the BHTI 204 series helicopter), and received FAA civil airworthiness certification in December 1994 as a restricted-category aircraft under Garlick's FAA type certificate H13WE. The reported airframe total time was 8,198 hours.

Portions of the fractured vertical fin and tail boom from N465JR were sent to the Safety Board's materials laboratory for metallurgical examination. Laboratory examination of the fracture surfaces determined that the left cap of the vertical fin front spar had fractured as a result of fatigue originating at the first rivet hole above the top of the tail boom, the same location as the separations described in the two previous accidents.

Following the Grove Hill accident, the FAA issued a general aviation airworthiness alert on BHTI models 204B, 205A, 205A-1, 205B, and UH-1; the alert appeared in the March 1997 issue of FAA Advisory Circular (AC) 43-16. The FAA cited the recent 205A-1 accident as the basis for its alert and recommended that "operators pay special attention to the vertical fin spar cap and inspect the discrepant area before the first flight of each day until more effective corrective action is available." The alert indicated that AD 71-21-02 had "previously addressed this subject," and that "further AD action is contemplated."

AD 71-21-02, which is applicable only to BHTI 205A and 205A-1 helicopters, mandates inspections of the subject rivet hole and surrounding area for cracks, along with immediate replacement of cracked components. These inspections include a visual check of the area before the first flight of each day, which may be accomplished by the pilot, as well as a more detailed, repetitive (100-hour) inspection that requires removing the rivet, and cleaning and removing the paint from the area around the rivet hole and surrounding area. However, aircraft whose vertical fin forward spars have been modified per BHTI Technical Bulletin 205-01-73-1 and Service

³ NTSB accident SEA96LA025.

Bulletin 205A-6 are exempt from the requirements of this AD. The helicopter involved in the Grove Hill accident (N68HJ) had been modified according to the applicable service bulletins during original manufacture, and was thus exempt from the requirements of AD 71-21-02. Also, AD 71-21-02 was not applicable to N97NW or to N465JR because those helicopters were type-certificated as a different make and model aircraft (Garlick UH-1H and TH-1L, respectively) and not as BHTI 205A or 205A-1 helicopters.

On November 27, 1996, about 3 weeks after the third accident, Garlick Helicopters, Inc., the type certificate holder for the UH-1H and TH-1L helicopters involved in the two most recent accidents, issued Alert Service Bulletin No. UH1-96-04 applicable to all UH-1B, UH-1E, UH-1L, TH-1L, HH-1K, UH-1H, UH-1F, UH-1P, and TH-1F helicopters certificated under FAA type certificates H13WE, H5NM, H10NM, H12NM, and H3NM. This service bulletin recommends repeated inspection of the left cap area of the vertical fin front spar. The inspection procedures and intervals described in the service bulletin are substantially identical to those contained in AD 71-21-02.

According to BHTI's party representative to the Coeur d'Alene accident, the tail boom for the commercial 205A and 205A-1 models (BHTI part number 205-032-802) differs from the military UH-1H tail boom (BHTI part number 205-032-800-71): the 205A and 205A-1 have a baggage compartment installed, use control tubes rather than cables and chain for tail rotor control, are designed for different tail boom and vertical fin flight loading, and contain additional doublers and stiffeners to strengthen the tail boom. However, the 205 series helicopters, the UH-1H, and the TH-1L are all constructed with a similar arrangement of bonded/nested cap angles in the area of their vertical fin spars where the fractures occurred. The 205A-1 vertical fin spar utilizes some stainless steel cap angles in the fracture area whereas the UH-1H's vertical fin spar cap angles are all aluminum. The vertical fin spar design on BHTI's commercial models 204B, 205A, 205A-1, and 205B are not identical. Nevertheless, the general design, construction, loading geometry, load carrying capacities, and fatigue strengths of each type's vertical fin structure are similar.

All three vertical fin fatigue fractures occurred on helicopters used in logging or other heavy lift operations that require repeatedly lifting heavy external loads. Although these helicopters are certificated to lift heavy loads, the use spectrum for which the helicopters were originally designed includes only a relatively few heavy lift cycles. In logging and other similar operations, however, the helicopter is used to continually lift and drop loads near the maximum capacity of the helicopter. According to BHTI, these types of operations generate frequent, repetitive, high-load cycles on the airframe (as many as two per minute in some operations) that far exceed those provided for by BHTI during original structural design.

The Safety Board is concerned that no inspections or service bulletins exist for type certificate holders (other than Garlick) that have converted former military H-1 type helicopters to civilian use. In addition, the FAA does not mandate compliance with the Garlick service bulletin, and, like AD 71-21-02, the Garlick service bulletin exempts helicopters with modified tail booms. The Grove Hill accident indicates that the tail booms on BHTI model 205A-1 helicopters used in repeated heavy lift operations are also subject to fracture. Because of the

potential for additional fractures of tail booms causing serious or fatal accidents, the Safety Board believes that the FAA should take actions to apply the inspection requirements specified in AD 71-21-02 to all BHTI model 204B, 205A, 205A-1, and 205B helicopters and to all military surplus BHTI H-1 type helicopters that perform repeated heavy lift operations.

The inspections specified in AD 71-21-02 are based on hours of operation. The tail separations discussed in this letter, however, occurred as a result of repeated application of high torque associated with heavy lift operations. Accumulation of fatigue damage thus is primarily related to the number of heavy lift cycles and only secondarily related to the number of hours of use. Because of this, the Safety Board is also concerned that inspection of the subject helicopters every 100 hours, as specified in AD 71-21-02, may not be sufficient to detect cracking in all of these helicopters that perform repeated heavy lift operations. The Board notes that the FAA, in conjunction with BHTI, has established a system for monitoring repeated heavy lift cycles on helicopters. The system used for BHTI model 214 series helicopters uses the Retirement Index Number (RIN) to calculate the total high lift events for the helicopter's main transmission areas that are difficult to inspect. Because the vertical fin on BHTI model 204B, 205A, 205A-1, and 205B helicopters and H-1 series helicopters can accumulate damage from repeated heavy lift operations, the Board believes that the FAA should implement a similar accounting system, then use it to determine inspection requirements for these helicopters engaged in heavy lift operations.

Therefore, to reduce the possibility of additional vertical fin separations on BHTI 204 and 205 series commercial helicopters and on former military H-1 type helicopters that have been type-certificated for civil use and that perform repetitive heavy lift operations, the National Transportation Safety Board recommends that the Federal Aviation Administration:

Amend Airworthiness Directive 71-21-02 to broaden its applicability to all Bell Helicopter Textron, Inc., model 204B, 205A, 205A-1, and 205B helicopters that perform repeated heavy lift operations, whether or not the helicopters are equipped with modified tail booms. (Urgent) (A-97-99)

Issue an Airworthiness Directive, based on AD 71-21-02, mandating inspection intervals for the area of the tail boom/vertical fin intersection, applicable to all variants of former military Bell Helicopter Textron, Inc., H-1 type helicopters that are converted to civil use and perform repeated heavy lift operations. (Urgent) (A-97-100)

Develop a system that accounts for the accumulation of heavy lift cycles on Bell Helicopter Textron, Inc., model 204B, 205A, 205A-1, and 205B helicopters and former military Bell Helicopter Textron, Inc., H-1 series helicopters; determine an appropriate inspection interval for the front spar of the vertical fin of these helicopters based on the accumulation of heavy lift cycles; and issue an airworthiness directive to require inspection of the spars at this interval. (A-97-101)

Chairman HALL, Vice Chairman FRANCIS, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in these recommendations.

By: 
Jim Hall
Chairman
