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National Transportation Safety Board

Washington, D.C. 20594
Safety Recommendation

Date: June 30, 1986
In reply refer to: A-86-52 and -53

Honorable Donald D. Engen
Administrator
Federal Aviation Administration
Washington, D.C. 20591

On June 16, 1986, in Jacksonville, Florida, a McDonnell Douglas (formerly Hughes) 369HE helicopter with a highway traffic reporting team and pilot on board experienced a control problem while hovering at 400 feet above the ground. The helicopter, equipped with an Allison 250-C18 engine, immediately began a rotation to the right and crashed shortly thereafter, killing the pilot and one passenger and seriously injuring the second passenger. Examination of the wreckage revealed that the tail rotor drive shaft aft flexible coupling was broken. This coupling, P/N 369A5501, is manufactured by the Bendix Corporation.

Although the investigation of this accident is continuing, preliminary metallurgical examination of the tail rotor drive shaft coupling pieces brought to the Materials Laboratory of the National Transportation Safety Board disclosed evidence of a preexisting condition that could have led to loss of tail rotor control. The forward diaphragm portion of the aft coupling had separated into multiple pieces, and fracture features on many of the breaks were obliterated by post fracture rotational smearing. However, features indicative of fatigue cracking were noted in three areas during the visual examination. An examination of these three areas with a scanning electron microscope confirmed the presence of fatigue cracking.

In 1981 the Federal Aviation Administration (FAA) issued Airworthiness Directive (AD) 81-17-02, requiring that Hughes Model 369D helicopters with a rotor brake installed be inspected at 100-hour intervals for cracked or damaged tail rotor drive shaft forward couplings until fail-safe components are installed in the forward tail rotor coupling. The AD does not require installation of the fail-safe components within any specific period of time.

The rotor brake on the Model 369 helicopter is installed just forward of the diaphragms of the tail rotor drive shaft forward coupling, and a flange is added to the coupling so that it can accept the brake. The part number of this modified coupling is 369H92564, and AD 81-17-02 is directed toward this component only when it is installed in Model 369D helicopters. Most of the Model 369 helicopters without a rotor brake installation use the P/N 369A5501 coupling, which was involved in the Jacksonville accident, in both the forward and aft positions. Similarly, most of the Model 369 helicopters with the rotor brake installation also use the P/N 369A5501 coupling in the aft position and the modified P/N 369H92564 coupling in the forward position. The two types of couplings are identical in the diaphragm areas.

The fail-safe components for the P/N 369H92564 coupling consist of a bolt head member which is attached to one end of the coupling and a socket member which is attached to the other end of the coupling. When the coupling is intact, the bolt head and socket do not contact each other. However, if the coupling should fail, the bolt head and socket contact each other, and the torque to the tail rotor blades is maintained. Helicopters with the fail-safe components are to be checked before each flight to verify that the drive shaft forward coupling has not failed. The fail-safe components are currently available from McDonnell Douglas in limited quantities.

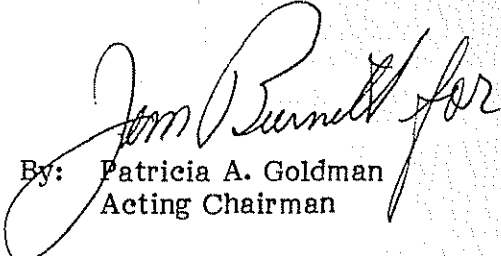
The Safety Board believes that McDonnell Douglas Model 369D helicopters with the fail-safe components installed are sufficiently protected from the effects of a failure of the P/N 369H92564 forward coupling. However, the Safety Board has three areas of concern in relation to the tail rotor drive shaft flexible couplings. First, the Safety Board is not convinced that the visual inspections required by paragraph (a)(2) of AD 81-17-02 are sufficient safeguards to detect fatigue cracking in the diaphragms of the forward coupling over an extended period of service time. Second, other Model 369 helicopters have rotor brake installations and tail rotor systems nearly identical to the tail rotor system on the 369D; however, no inspections or fail-safe components are required on these helicopters. Third, the Jacksonville accident has demonstrated that the P/N 369A5501 coupling is also susceptible to fatigue failure. Therefore, the Safety Board is concerned that both the forward and aft couplings of the tail rotor drive shaft are at risk, and that failure of either coupling that is not protected by the fail-safe mechanism can lead to a potentially catastrophic accident.

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

Issue an Emergency Airworthiness Directive to require (1) an immediate inspection by an approved method of all tail rotor drive shaft flexible couplings (P/N 369A5501 or P/N 369H92564), exclusive of those forward couplings included in Airworthiness Directive 81-17-02, which are installed on any McDonnell Douglas Model 369 helicopters, (2) that any coupling which contains cracking or damage be removed from service, and (3) periodic inspections of the couplings at an interval which will detect cracking before it becomes critical to safe operation of the helicopter. (Class I, Urgent Action) (A-86-52)

Issue an Airworthiness Directive to require (1) installation of fail-safe components within the tail rotor drive shaft flexible couplings (P/N 369A5501 and P/N 369H92564) on applicable McDonnell Douglas Model 369 helicopters within a reasonable time period, (2) that helicopters with the fail-safe system be checked before each flight to verify that the tail rotor drive shaft couplings are intact and not damaged, and (3) that any broken or damaged couplings discovered during the preflight inspection be removed from service. (Class II, Priority Action) (A-86-53)

GOLDMAN, Acting Chairman, and BURNETT, LAUBER, and NALL, Members, concurred in these recommendations.


By: Patricia A. Goldman
Acting Chairman