

Log 1963



National Transportation Safety Board

Washington, D.C. 20594
Safety Recommendation

Date: May 22, 1987

In reply refer to: A-87-63 through A-87-65

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

The National Transportation Safety Board is currently investigating an accident which occurred in Abilene, Texas, on September 6, 1986, and which involved a Fairchild Hiller FH-1100 helicopter, operating as a sight-seeing flight. Preliminary information indicates that during initial climb the helicopter lost directional control as a result of the separation of one of the tail rotor blades from the tail rotor assembly. Although the five persons onboard escaped injury, the helicopter was substantially damaged.

The Safety Board's examination of the tail rotor assembly disclosed that the tension-torsion (T-T) bar, Part No. (P/N) 24-55106, for one of the blades had separated through the attachment bolt holes. The T-T bar transmits both centrifugal (tension) and blade pitch (torsion) loads of the blade to the hub. The bar is composed of 11 identically shaped stainless steel straps encapsulated in grease inside the tail rotor hub and the inboard end of the tail rotor blade. Metallurgical examination disclosed features indicative of stress corrosion cracking over many parts of the fractures in the straps. Similar cracks were found in the opposite T-T bar that did not fail.

Chlorine rich deposits were found on portions of the fractures in the separated T-T bar. Also, the grease (specified to be Aero Shell 14) from the T-T bar cavity for both rotor blades was darkened, and the cavity for the intact blade contained a small amount of fluid having an unpleasant odor. Analysis of samples of the grease from both tail rotor cavities revealed excessive amounts of chlorine. The Safety Board believes that these conditions may be symptoms of water-contaminated grease. The presence of chlorine greatly increases the potential for stress corrosion cracking in many stainless steels.

The failed T-T bar was new when it was installed on the accident aircraft 508.2 flight-hours before the accident. The number of hours on the bar was far below the life limit of 4,600 hours. Grease is added to the tail rotor assembly every 100 hours, and the assembly is required to be overhauled every 1,200 hours. However, this overhaul does not require that the T-T bar be inspected for cracks. Since the failure occurred in a contaminated environment at an early point in the life limit of the part, the periodic 100-hour greasing of the assembly is suspected of producing the contamination.

In September 1976, the Safety Board's Metallurgical Laboratory (presently the Materials Laboratory) issued Report No. 76-127, which documents a similar failure of a P/N 24-55106 T-T bar; the failed T-T bar was installed on a Fairchild Hiller FH-1100

helicopter. Evidence of fatigue cracking and a corrosion-assisted cracking mechanism was discovered on portions of the strap separations. Areas of fatigue cracking initiated at a rough surface in the wall of the attachment bolt hole. In the Abilene accident, no evidence of a rough or deteriorated hole wall was found.

In 1977, the Federal Aviation Administration (FAA) issued Airworthiness Directive (AD) 77-07-08, which required a one-time inspection of certain P/N 24-55106 T-T bars installed on Fairchild Hiller Model FH-1100 series helicopters. The inspection was designed to detect an improper surface finish in the wall of the attachment bolt holes.

The Safety Board believes that AD 77-07-08 adequately addressed the problem of P/N 24-55106 T-T bars which failed as a result of damaged or deteriorated hole wall surfaces. However, the Abilene accident illustrates that, even when the hole wall is undamaged, the T-T bar may fail as a result of chlorine contamination of the grease surrounding the T-T bar. The Safety Board is concerned that the source of the chlorine contamination may be water in the lubricating grease introduced during the periodic 100-hour servicing of the assembly and that additional helicopters may have been subjected to this problem.

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

Issue an airworthiness directive to require within a specified period an inspection of the grease surrounding the tail rotor tension-torsion bars (Part No. 24-55106) on Fairchild Hiller FH-1100 series helicopters. If the grease appears clean, no further action should be required. If the grease is excessively darkened, has an unpleasant odor, or is obviously contaminated, the tension-torsion bar should be inspected before further flight, using an approved method, for evidence of cracking in the individual straps of the bar. Bars with any cracks should be removed from service before further flight. Instances of contaminated grease or cracks in the tension-torsion bar should be reported to the Federal Aviation Administration. (Class II, Priority Action) (A-87-63)

Based at least in part on the results of the inspections required by the airworthiness directive mentioned in Safety Recommendation A-87-63, review and evaluate the need for a mandatory repetitive inspection of the Part No. 24-55106 tail rotor tension-torsion bars installed on Fairchild Hiller FH-1100 series aircraft. (Class II, Priority Action) (A-87-64)

Publicize the circumstances and findings of the September 6, 1986, accident in Abilene, Texas, involving a Fairchild Hiller FH-1100 helicopter, in an issue of the Federal Aviation Administration "General Aviation Airworthiness Alerts," AC 43-16, so that operators of all types of aircraft can become aware of the potential problems associated with contaminated grease. (Class II, Priority Action) (A-87-65)

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


By: Jim Burnett
Chairman

National Transportation Safety Board
Washington, D.C. 20594

Brief of Accident

File No. - 1972 9/06/86 ARILENE, TX A/C Reg. No. N5068F Time (Lcl) - 1830 CDT

Basic Information

Type Operating Certificate-NONE (GENERAL AVIATION)

Aircraft Damage
SUBSTANTIAL
Fire
ON GROUND

Injuries
Fatal 0
Serious 0
Minor 0
Name 1
5

Type of Operation - SIGHT-SEEING
Flight Conducted Under - 14 CFR 91
Accident Occurred During - LANDING

Aircraft Information

Make/Model - HILLER FH-1100
Landing Gear - SKID
Max Gross Wt - 2530
No. of Seats - 4

Eng Make/Model - Allison 240-C18
Number Engines - 1
Engine Type - TURBO-SHAFT
Rated Power - 274 HP

ELT Installed/Activated - NO -N/A
Stall Warning System - NO

Environment/Operations Information

Weather Data
Wx Briefings - UNK/NR
Method - UNK/NR
Completeness - WEATHERS NOT PERTINENT
Basic Weather - VMC
Wind Dir/Speed - 030/008 KTS
Visibility - 30.0 SM
Lowest Sky/Clouds - 3000 FT SCATTERED
Lowest Ceiling - NONE
Obstructions to Vision - NONE
Precipitation - NONE
Condition of Light - DAYLIGHT

Itinerary
Last Departure Point
SAME AS ACC/INC
Destination
LOCAL

ATC/Airspace
Type of Flight Plan - NONE
Type of Clearance - NONE
Type Apch/Lndg - FORCED LANDING

Airport Proximity
OFF AIRPORT/STRIP

Airport Data
ARILENE
Runway Ident - N/A
Runway Lth/Wid - N/A
Runway Surface - N/A
Runway Status - N/A

Personnel Information

Pilot-In-Command
Certificate(s)/Rating(s)
COMMERCIAL

HELICOPTER

Age - 60
Biennial Flight Review
Current - YES
Months Since - 13
Aircraft Type - C-150

Medical Certificate - VALID MEDICAL-WAIVERS/LIMIT
Flight Time (Hours)
Total - 4H70

Last 24 Hrs - 4
Last 30 Days - UNK/NR
Last 90 Days - 39
Rotorcraft - 2381

Instrument Rating(s) - NONE

Narrative

THE FLT WAS CONDUCTING SIGHT-SEEING FLTS FROM A ROVEDO/FAIRGROUND AREA. DURING A CRITICAL PART OF A TAKEOFF, A TAIL ROTOR BLADE SEPARATED & THE FLT LOST DIRECTIONAL CONTROL. HE ATTEMPTED AN AUTOROTATIVE LANDING, AFTER SPINNING AROUND ABOUT 3 TIMES, THE FLT PULLED FULL COLLECTIVE, JUST BEFORE THE HELICOPTER CRASHED, BUT IT WAS STILL BADLY DAMAGED. AN INVESTIGATION REVEALED THAT A TAIL ROTOR TENSION-TORSION (T-T) BAR ASSEMBLY, PN 24-55106, HAD FAILED WHERE THE ATTACHMENT BOLT GOES THRU THE T-T STRAPS. A METALLURGICAL EXAM REVEALED CHLORINE RICH DEPOSITS IN THE FRACTURE AREA. THE GREASE FROM THE T-T BAR CAVITY HAD DARKENED & THE CAVITY FOR THE OTHER SET OF T-T STRAPS CONTAINED A SMALL AMOUNT OF FLUID WITH AN UNPLEASANT ODOR. AN ANALYSIS OF THE GREASE REVEALED EXCESSIVE AMOUNTS OF CHLORINE. THERE WAS EVIDENCE THAT WATER & CHLORINE CONTAMINATION HAD RESULTED IN STRESS CORROSION & EVENTUAL FAILURE OF THE T-T BAR ASSEMBLY.

Brief of Accident (Continued)

File No. - 1972 9/06/86 ARILENE, TX A/C Reg. No. N5068F Time (Lcl) - 1830 CDT

Occurrence #1 AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION
Phase of Operation TAKEOFF - INITIAL CLIMB

- Findings(s)
1. ROTOR SYSTEM, TAIL ROTOR BLADE CUFF - CONTAMINATION
2. MAINTENANCE - INADEQUATE - OTHER MAINTENANCE PSNL
3. ROTOR SYSTEM, TAIL ROTOR BLADE CUFF - STRESS CORROSION
4. ROTOR SYSTEM, TAIL ROTOR BLADE - SEPARATION

Occurrence #2 LOSS OF CONTROL - IN FLIGHT
Phase of Operation TAKEOFF - INITIAL CLIMB

Findings(s)
5. DIRECTIONAL CONTROL - NOT POSSIBLE -

Occurrence #3 FORCED LANDING
Phase of Operation DESCENT - EMERGENCY

Findings(s)
6. AUTOROTATION - ATTEMPTED - PILOT IN COMMAND

Occurrence #4 IN FLIGHT COLLISION WITH TERRAIN
Phase of Operation LANDING

---Probable Cause---

The National Transportation Safety Board determines that the Probable Cause(s) of this accident is/are findings(s) 1,3,4

Factor(s) relating to this accident is/are findings(s) 2