



AVIATION



HIGHWAY



MARINE



RAILROAD



PIPELINE

# Aviation Investigation Final Report

<b>Location:</b>	Waverly, Iowa	<b>Accident Number:</b>	CHI03LA217
<b>Date &amp; Time:</b>	July 20, 2003, 08:30 Local	<b>Registration:</b>	N51699
<b>Aircraft:</b>	Enstrom F-28C	<b>Aircraft Damage:</b>	Substantial
<b>Defining Event:</b>		<b>Injuries:</b>	3 None
<b>Flight Conducted Under:</b>	Part 91: General aviation - Aerial observation		

## Analysis

The helicopter sustained substantial damage when the main rotor blade impacted the tail boom during a forced landing. The helicopter experienced in-flight vibrations prior to the forced landing. The pilot stated that the helicopter experienced extreme vibration in-flight at 200 feet above ground level. He said that helicopter control was "10% to nil." An examination revealed that one of three Push-Pull Rod Assemblies, part number 28-16253-1, was found corroded and separated. The operator's fleet of aircraft was examined and four other control rods were found with corrosion. Examination of the rod with the separation from the accident helicopter at the National Transportation Safety Board's Materials Laboratory revealed that "most of the fracture areas were on a plane that was nearly perpendicular to the longitudinal axis of the rod, indicative of a brittle fracture mechanism such as fatigue cracking." The pilot stated, "Pitch control rod has no inspection procedure at this time. It rusted from inside and not visible from outside." Subsequent to the accident, Enstrom issued Service Directive Bulletin (SDB) No. 0096. The bulletin directs visual inspection of control rods with part number 28-16253-1 and 28-16253-101 according to their time in service on F-28A, F-28C, F-28F, 280, 280C, 280F, and 280FX helicopters.

## Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The main rotor blade push-pull rods being corroded, sustaining fatigue, and separating in cruise and the main rotor blade contacting the tail boom during the emergency landing. Factors were the diminished aircraft control and the vibrations encountered during flight after the rod separation.

## Findings

Occurrence #1: ROTOR FAILURE/MALFUNCTION

Phase of Operation: CRUISE

### Findings

1. (C) ROTOR SYSTEM,MAIN ROTOR TENSION TORSION BAR - CORRODED
2. (F) AIRCRAFT CONTROL - DIMINISHED
3. CONDITION(S)/STEP(S) NOT LISTED - MANUFACTURER
4. (C) ROTOR SYSTEM,MAIN ROTOR TENSION TORSION BAR - FATIGUE
5. (C) ROTOR SYSTEM,MAIN ROTOR TENSION TORSION BAR - SEPARATION
6. (F) ROTOR SYSTEM,MAIN ROTOR BLADE - VIBRATION

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Occurrence #2: FORCED LANDING

Phase of Operation: EMERGENCY LANDING

### Findings

7. (C) ROTOR SYSTEM,MAIN ROTOR - OTHER

## Factual Information

On July 20, 2003, about 0830 central daylight time, an Enstrom F-28C helicopter, N51699, piloted by a commercial pilot, sustained substantial damage when the main rotor blade impacted the tail boom during a forced landing near Waverly, Iowa. The helicopter experienced in-flight vibrations prior to the forced landing. The sightseeing flight was operating under 14 CFR Part 91. Visual meteorological conditions prevailed at the time of the accident. No flight plan was on file. The pilot and two passengers were uninjured. The local flight originated from Waverly Municipal Airport, near Waverly, Iowa.

The pilot stated:

Flying with two passengers. Notice small [vibration] and about one minute later, extreme vibration 200 ft [above ground level] over trees and houses. [Initiated] emergency landing to parking lot. Vibration very extreme, if seat belts were not on it would have thrown occupants from aircraft. Control 10% to nil. Vibration was so bad that visibility was poor to none. Touchdown was not hard but #1 blade was flopping about and struck tail, damage to blade and tail cone. If we would have been over 200 [feet above ground level] this would have certainly been more serious.

The Federal Aviation Administration and helicopter manufacturer performed an examination of the accident helicopter. The examination revealed that one of three Push-Pull Rod Assemblies, part number 28-16253-1, was found with a separation. The internal surface of that rod assembly was found corroded. Another rod assembly was disassembled and was found to contain a liquid. The helicopter's third rod assembly was disassembled. No anomalies were found with that third rod assembly. The operator's fleet of aircraft was examined and four other control rods were found with corrosion.

The two rods from the accident helicopter were sent to the National Transportation Safety Board's Materials Laboratory for examination. The laboratory produced Materials Laboratory Factual Report number 03-085. Excerpts from the report stated:

Visual examination of the fractured rod portion showed the presence of substantial rust-colored corrosion deposits on the inside of the rod adjacent to the fracture. These deposits extended over a distance of about 2 inches above the fracture location. The corrosion damage had thinned the wall of the rod adjacent to the fracture, and in some areas the corrosion appeared to penetrate nearly through the wall thickness to the exterior surface of the rod. ... Examination of the fracture areas on the larger portion of the broken rod after ultrasonic cleaning in acetone revealed that most of the fracture areas were on a

plane that was nearly perpendicular to the longitudinal axis of the rod, indicative of a brittle fracture mechanism such as fatigue cracking.

Concerning the pitch control push-pull rod assemblies, the pilot stated:

Pitch control rod has no inspection procedure at this time. It rusted from inside and not visible from outside. Must remove both pitch control ends and visually check inside tube.

Subsequent to the accident, Enstrom issued Service Directive Bulletin (SDB) No. 0096. The bulletin directs visual inspection of control rods with part number 28-16253-1 and 28-16253-101 according to their time in service on F-28A, F-28C, F-28F, 280, 280C, 280F, and 280FX helicopters. Excerpts from the bulletin compliance section stated:

Within ten (10) hours time in service or at the next annual inspection, which ever occurs first, review the aircraft maintenance records to determine the date "new" main rotor push-pull rods were installed in the aircraft. If the installation date for "new" main rotor push-pull rods can not be determined from the maintenance records, use the aircraft "DATE MFD." found on the aircraft data plate.

For main rotor push-pull rods (P/N 28-16253-1 or -101) in service for more than twenty (20) years, inspect the push-pull rods in accordance with (IAW) paragraph 5.1 of this SDB within ten (10) hours time in service or at the next annual inspection, which ever occurs first.

For main rotor push-pull rods (P/N 28-16253-1 or -101) in service between ten (10) years and twenty (20) years, inspect the push-pull rods IAW with paragraph 5.1 of this SDB within fifty (50) hours time in service or at the next annual inspection, which ever occurs first.

For main rotor push-pull rods (28-16253-1 or -101) in service less than ten (10) years, inspect the push-pull rods IAW paragraph 5.1 of this SDB before the push-pull rods reach ten (10) years time in service.

## Pilot Information

<b>Certificate:</b>	Commercial; Flight instructor	<b>Age:</b>	60, Male
<b>Airplane Rating(s):</b>	Single-engine land; Multi-engine land	<b>Seat Occupied:</b>	Left
<b>Other Aircraft Rating(s):</b>	Helicopter	<b>Restraint Used:</b>	
<b>Instrument Rating(s):</b>	Airplane	<b>Second Pilot Present:</b>	No
<b>Instructor Rating(s):</b>	Airplane multi-engine; Airplane single-engine; Helicopter; Instrument airplane	<b>Toxicology Performed:</b>	No
<b>Medical Certification:</b>	Class 3 Valid Medical--w/ waivers/lim	<b>Last FAA Medical Exam:</b>	March 3, 2003
<b>Occupational Pilot:</b>	Yes	<b>Last Flight Review or Equivalent:</b>	March 2, 2003
<b>Flight Time:</b>	45000 hours (Total, all aircraft), 8000 hours (Total, this make and model), 45000 hours (Pilot In Command, all aircraft), 200 hours (Last 90 days, all aircraft), 8 hours (Last 24 hours, all aircraft)		

## Aircraft and Owner/Operator Information

<b>Aircraft Make:</b>	Enstrom	<b>Registration:</b>	N51699
<b>Model/Series:</b>	F-28C	<b>Aircraft Category:</b>	Helicopter
<b>Year of Manufacture:</b>		<b>Amateur Built:</b>	
<b>Airworthiness Certificate:</b>	Normal	<b>Serial Number:</b>	416
<b>Landing Gear Type:</b>	Skid	<b>Seats:</b>	3
<b>Date/Type of Last Inspection:</b>	July 6, 2003 Annual	<b>Certified Max Gross Wt.:</b>	2200 lbs
<b>Time Since Last Inspection:</b>	20 Hrs	<b>Engines:</b>	1 Reciprocating
<b>Airframe Total Time:</b>	3100 Hrs at time of accident	<b>Engine Manufacturer:</b>	Lycoming
<b>ELT:</b>		<b>Engine Model/Series:</b>	HIO360E1AD
<b>Registered Owner:</b>	P and N Corp	<b>Rated Power:</b>	205 Horsepower
<b>Operator:</b>		<b>Operating Certificate(s) Held:</b>	None

## Meteorological Information and Flight Plan

<b>Conditions at Accident Site:</b>	Visual (VMC)	<b>Condition of Light:</b>	Day
<b>Observation Facility, Elevation:</b>	ALO,873 ft msl	<b>Distance from Accident Site:</b>	12 Nautical Miles
<b>Observation Time:</b>	07:54 Local	<b>Direction from Accident Site:</b>	155°
<b>Lowest Cloud Condition:</b>	Few / 900 ft AGL	<b>Visibility</b>	5 miles
<b>Lowest Ceiling:</b>		<b>Visibility (RVR):</b>	
<b>Wind Speed/Gusts:</b>	7 knots / None	<b>Turbulence Type Forecast/Actual:</b>	/
<b>Wind Direction:</b>	290°	<b>Turbulence Severity Forecast/Actual:</b>	/
<b>Altimeter Setting:</b>	29.93 inches Hg	<b>Temperature/Dew Point:</b>	24°C / 21°C
<b>Precipitation and Obscuration:</b>	No Obscuration; No Precipitation		
<b>Departure Point:</b>	WAVERLY, IA (C25 )	<b>Type of Flight Plan Filed:</b>	None
<b>Destination:</b>	(C25 )	<b>Type of Clearance:</b>	None
<b>Departure Time:</b>	08:17 Local	<b>Type of Airspace:</b>	Class G

## Wreckage and Impact Information

<b>Crew Injuries:</b>	1 None	<b>Aircraft Damage:</b>	Substantial
<b>Passenger Injuries:</b>	2 None	<b>Aircraft Fire:</b>	None
<b>Ground Injuries:</b>	N/A	<b>Aircraft Explosion:</b>	None
<b>Total Injuries:</b>	3 None	<b>Latitude, Longitude:</b>	42.741943,-92.508056

## Administrative Information

**Investigator In Charge (IIC):** Malinowski, Edward

**Additional Participating Persons:** Jay Burton; Federal Aviation Administration; Ankenny, IA  
William E Taylor; Enstrom Helicopter Corporation; Menominee, MI

**Original Publish Date:** June 30, 2004

**Last Revision Date:**

**Investigation Class:** [Class](#)

**Note:**

**Investigation Docket:** <https://data.nts.gov/Docket?ProjectID=57556>

The National Transportation Safety Board (NTSB) is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant events in other modes of transportation—railroad, transit, highway, marine, pipeline, and commercial space. We determine the probable causes of the accidents and events we investigate, and issue safety recommendations aimed at preventing future occurrences. In addition, we conduct transportation safety research studies and offer information and other assistance to family members and survivors for each accident or event we investigate. We also serve as the appellate authority for enforcement actions involving aviation and mariner certificates issued by the Federal Aviation Administration (FAA) and US Coast Guard, and we adjudicate appeals of civil penalty actions taken by the FAA.

The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, “accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties ... and are not conducted for the purpose of determining the rights or liabilities of any person” (Title 49 *Code of Federal Regulations* section 831.4). Assignment of fault or legal liability is not relevant to the NTSB’s statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report (Title 49 *United States Code* section 1154(b)). A factual report that may be admissible under 49 *United States Code* section 1154(b) is available [here](#).