# Aviation Investigation Final Report

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| **Location:** | Elizabeth, Colorado | **Accident Number:** | DEN01LA106 |
| **Date & Time:** | May 29, 2001, 18:45 Local | **Registration:** | N83GT |
| **Aircraft:** | Enstrom F-28C | **Aircraft Damage:** | Substantial |
| **Defining Event:** | | **Injuries:** | 2 None |
| **Flight Conducted Under:** | Part 91: General aviation - Instructional | | |

## Analysis

The instructor was flying the helicopter and giving instruction on steep approaches to the private pilot. During a demonstrated steep approach, they were in translation and at approximately 80 feet above ground level (AGL) when he noticed the rotor and engine RPM start to decay. The student pilot stated that, the instructor was giving him a visual reference between their indicated airspeed, which was approximately 50 MPH, and what the "picture on the ground" looked like. As the instructor continued the descent, the student pilot observed that the engine speed was at approximately 2900 RPM, and the manifold pressure indicated approximately 15 inches. The student pilot heard a change in rotor RPM and noticed that the both the rotor RPM and manifold pressures were dropping. We were "probably at 50 to 75 feet AGL with a visual ground speed of about 10 mph." The instructor stated "we are having an engine failure" lowered the collective control lever and increased the throttle. There was no reaction in manifold pressure and the main rotor RPM continued to decrease. The instructor landed the helicopter in a field just short of the intended landing point. The helicopter hit the ground at a higher than normal descent rate and the main rotor blades struck the tail boom, severing the tail rotor and tail rotor gearbox from the tailboom. Examination of the engine revealed that the idle speed and mixture settings were out of adjustment; however, the cause of the loss of engine power was not determined. The density altitude was calculated to be 7,943 feet msl.

## Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: the loss of engine power during approach for an undetermined reason. A contributing factor was the high density altitude.

### Findings

Occurrence #1: LOSS OF ENGINE POWER
Phase of Operation: APPROACH - VFR PATTERN - FINAL APPROACH

Findings
1. (C) REASON FOR OCCURRENCE UNDETERMINED
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Occurrence #2: FORCED LANDING
Phase of Operation: EMERGENCY DESCENT/LANDING

Findings
2. AUTOROTATION - INITIATED - PILOT IN COMMAND
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Occurrence #3: HARD LANDING
Phase of Operation: EMERGENCY LANDING

Findings
3. (F) WEATHER CONDITION - HIGH DENSITY ALTITUDE
4. MISC ROTORCRAFT,MAIN ROTOR/TAIL BOOM CONTACT

## Factual Information

On May 29, 2001, at approximately 1845 mountain daylight time, an Enstrom F-28C helicopter, N83GT, sustained substantial damage when it landed hard following a total loss of engine power near Elizabeth, Colorado. The commercial certificated flight instructor and the private pilot receiving instruction were not injured. Visual meteorological conditions prevailed, and no flight plan had been filed for the local instructional flight being conducted under Title 14 CFR Part 91. The flight originated from Elizabeth, Colorado, at approximately 1745.

According to the instructor's statement, he was flying the helicopter and giving instruction on steep approaches to the private pilot. The instructor stated that during the demonstrated steep approach, they were in translation and at approximately 80 feet above ground level (AGL) when he noticed the rotor and engine RPM start to decay. The student pilot stated that, the instructor was giving him a visual reference between their indicated airspeed, which was approximately 50 MPH, and what the "picture on the ground" looked like. As the instructor continued the descent, the student pilot observed that the engine speed was at approximately 2900 RPM, and the manifold pressure indicated approximately 15 inches. The student pilot heard a change in rotor RPM and noticed that the both the rotor RPM and manifold pressures were dropping. We were "probably at 50 to 75 feet AGL with a visual ground speed of about 10 mph." The instructor stated "we are having an engine failure" lowered the collective control lever and increased the throttle. There was no reaction in manifold pressure and the main rotor RPM continued to decrease. The instructor landed the helicopter in a field just short of the intended landing point. The helicopter hit the ground at a higher than normal descent rate and the main rotor blades struck the tail boom, severing the tail rotor and tail rotor gearbox from the tailboom.

During an on site inspection of the helicopter, a manufacturer's representative from Textron-Lycoming stated that the helicopter engine compartment revealed no evidence of preaccident catastrophic mechanical malfunction or fire. There was no evidence of fuel or oil leakage from the engine, attached components, respective hoses, lines and fittings. The throttle and mixture controls were observed to "hit the stops" at their respective positions. The exhaust pipe exhibited a light gray discoloration and remained free of oil residue. The turbocharger turbine impellor remained intact and free of foreign object damage.

After completing the initial inspection, it was determined the engine was in an operable condition and an engine run-up and functional check could be completed. All systems were checked, and the main rotor drive belt was disengaged. The engine was started using normal procedures. The oil and fuel pressure gauges were within normal operating ranges. Manifold pressure was 10-11 inches Hg. After an initial warm-up period, the engine throttle was advanced to 1800 rpm (no rotor load) to complete a magneto check. During the magneto check, a 200 rpm drop was noted for both left and right magnetos. The throttle was advanced

to 2200 rpm and the engine began to run rough. The cockpit mixture control was manipulated toward the lean setting and the engine ran smoothly. The manufacturer's representative noted an indicated needle rise at the EGT gauge and that the mixture control required an excessively lean setting (positional) to obtain a smooth running engine. The engine was operated using the electric fuel boost pump and engine driven fuel pump (alternately) with no adverse affects noted in engine operation. When the throttle was reduced to the "hard idle stop," approximately 1000 rpm was indicated on the tachometer. The mixture control was utilized to conduct an idle mixture check (leaning out) at which time an approximate rise of 200 RPM was indicated at the tachometer. After the engine was shutdown, the engine compartment was examined. The exhaust system tail pipe exhibited a dark black discoloration. No fuel or oil leaks were noted.

The manufacturer's specifications require "a minimum idle speed of 1500 RPM with clutch (drive belt) disengaged" and it also states, "an increase of more then 50 RPM while 'leaning out,' indicates an excessively rich idle mixture setting."

The helicopter was transported to Beegles Aircraft Service, Inc., Greeley, Colorado. During the second engine run-up check, all systems were checked and the main rotor drive belt was disengaged. The engine was started using normal procedures. The oil and fuel pressures were within normal operating ranges. Manifold pressure was 11 inches Hg. After an initial warm-up period, the engine throttle was advanced to 1800 rpm to complete the magneto check. During the magneto check, a 350 rpm drop was noted for the left magneto and a 400 rpm drop was noted for the right magneto. During this time, a constant adjustment (leaning) of the cockpit mixture control was required to maintain a smooth running engine. When the throttle was reduced to the "hard idle stop," the tachometer indicated 1100 rpm with the fuel boost pump off and 1050 rpm with fuel boost bump on. Adjusting the cockpit mixture control to the full out position (full lean), resulted in a 1500 rpm indication on the tachometer and a rough "popping" engine. Any changes in throttle setting at this time resulted in a loss of engine rpm or engine shut-down. After completing the engine run-up check, the engine compartment was examined and again, no fuel or oil leaks were noted. The exhaust system tail pipe exhibited a dark black discoloration.

A review of the Enstrom Maintenance Manual, section 13-1, B. Operating Specifications, lists the minimum idle rpm (clutch disengaged) as 1500 rpm. The manual also states that the "engine may be leaned at 75 percent power or below 1600 degrees F. (never exceeding 1650 degrees F., EGT) on rich side of peak," but required that the "mixture must be full rich for landing and takeoff regardless of power for proper engine cooling." According to the helicopter engine maintenance logbook, the fuel injection servo had been removed for overhaul and subsequently reinstalled on April 13, 2001, in West Lebanon, New Hampshire. The helicopter was subsequently relocated to the Denver, Colorado, area by the owner. A change in field elevation of approximately 6,000 feet transpired from where the helicopter was purchased to where the accident occurred. No logbook entries identifying any re-adjustment of the idle speed or mixture settings were noted.

The idle speed and mixture settings were adjusted in accordance with the Enstrom Maintenance Manual and Textron Lycoming Operator's Manual. The engine was started following the post engine adjustment procedures and the engine clearing procedures were completed. Following an initial warm-up period, the throttle was reduced to the "hard idle stop," and the cockpit mixture control was set to the full in position (full rich). The cockpit mixture control was leaned approximately one full turn from the full rich position; the tachometer indicated 1500 rpm with the fuel boost pump off and 1450 rpm with fuel boost bump on. The oil and fuel pressure gauges were within normal operating ranges. Engine RPM minimums were within Enstrom specifications; however, the completion of the idle adjustment check could not be accomplished given that the magneto check revealed an excessive "mag-drop" of 350 rpm for the left magneto and 400 rpm for the right magneto. After the engine was shut-down, the engine compartment was examined and again, no fuel or oil leaks were noted. The cause of the excessive "mag-drop" for each magneto was not determined.

The environmental conditions at the time of the accident were as follows: temperature, 18 degrees Celsius; dew point, 7 degrees Celsius; wind, 130 degrees at 7 knots; altimeter setting, 29.93" Hg, impact elevation, 6,150 feet msl; computed density altitude, 7,943 feet msl.

## Pilot Information

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| **Certificate:** | Commercial; Flight instructor | **Age:** | 38,Male |
| **Airplane Rating(s):** | None | **Seat Occupied:** | Left |
| **Other Aircraft Rating(s):** | Helicopter | **Restraint Used:** | |
| **Instrument Rating(s):** | Helicopter | **Second Pilot Present:** | Yes |
| **Instructor Rating(s):** | Helicopter | **Toxicology Performed:** | No |
| **Medical Certification:** | Class 2 Valid Medical--no waivers/lim. | **Last FAA Medical Exam:** | August 18, 2000 |
| **Occupational Pilot:** | Yes | **Last Flight Review or Equivalent:** | May 8, 2001 |
| **Flight Time:** | 1409 hours (Total, all aircraft), 197 hours (Total, this make and model), 1349 hours (Pilot In Command, all aircraft), 91 hours (Last 90 days, all aircraft), 43 hours (Last 30 days, all aircraft), 3 hours (Last 24 hours, all aircraft) | | |

## Student pilot Information

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| **Certificate:** | Private | **Age:** | 37,Male |
| **Airplane Rating(s):** | Single-engine land | **Seat Occupied:** | Right |
| **Other Aircraft Rating(s):** | Helicopter | **Restraint Used:** | |
| **Instrument Rating(s):** | None | **Second Pilot Present:** | Yes |
| **Instructor Rating(s):** | None | **Toxicology Performed:** | No |
| **Medical Certification:** | Class 3 Valid Medical--no waivers/lim. | **Last FAA Medical Exam:** | March 24, 1999 |
| **Occupational Pilot:** | Yes | **Last Flight Review or Equivalent:** | April 30, 2001 |
| **Flight Time:** | 219 hours (Total, all aircraft), 81 hours (Total, this make and model), 164 hours (Pilot In Command, all aircraft), 48 hours (Last 90 days, all aircraft), 37 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft) | | |

## Aircraft and Owner/Operator Information

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| **Aircraft Make:** | Enstrom | **Registration:** | N83GT |
| **Model/Series:** | F-28C | **Aircraft Category:** | Helicopter |
| **Year of Manufacture:** | | **Amateur Built:** | |
| **Airworthiness Certificate:** | Normal | **Serial Number:** | 308 |
| **Landing Gear Type:** | Skid | **Seats:** | 3 |
| **Date/Type of Last Inspection:** | May 29, 2001 Annual | **Certified Max Gross Wt.:** | 2350 lbs |
| **Time Since Last Inspection:** | 1.3 Hrs | **Engines:** | 1 Reciprocating |
| **Airframe Total Time:** | 2005.9 Hrs at time of accident | **Engine Manufacturer:** | Lycoming |
| **ELT:** | Not installed | **Engine Model/Series:** | 4HIO-360-EIAD |
| **Registered Owner:** | Eagle Flight Helicopters | **Rated Power:** | 205 Horsepower |
| **Operator:** | | **Operating Certificate(s) Held:** | None |

## Meteorological Information and Flight Plan

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| **Conditions at Accident Site:** | Visual (VMC) | **Condition of Light:** | Day |
| **Observation Facility, Elevation:** | KAPA,5883 ft msl | **Distance from Accident Site:** | 19 Nautical Miles |
| **Observation Time:** | 18:53 Local | **Direction from Accident Site:** | 95° |
| **Lowest Cloud Condition:** | Scattered / 7000 ft AGL | **Visibility** | 10 miles |
| **Lowest Ceiling:** | Broken / 20000 ft AGL | **Visibility (RVR):** | |
| **Wind Speed/Gusts:** | 7 knots / 0 knots | **Turbulence Type Forecast/Actual:** | / |
| **Wind Direction:** | 130° | **Turbulence Severity Forecast/Actual:** | / |
| **Altimeter Setting:** | 29.93 inches Hg | **Temperature/Dew Point:** | 18°C / 7°C |
| **Precipitation and Obscuration:** | No Obscuration; No Precipitation | | |
| **Departure Point:** | Elizabeth, CO (NONE) | **Type of Flight Plan Filed:** | None |
| **Destination:** | Elizabeth, CO (NONE) | **Type of Clearance:** | VFR |
| **Departure Time:** | 17:45 Local | **Type of Airspace:** | Class E |

## Wreckage and Impact Information

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| **Crew Injuries:** | 2 None | **Aircraft Damage:** | Substantial |
| **Passenger Injuries:** | | **Aircraft Fire:** | None |
| **Ground Injuries:** | N/A | **Aircraft Explosion:** | None |
| **Total Injuries:** | 2 None | **Latitude, Longitude:** | 39.550834,-104.505554 |

## Administrative Information

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| **Investigator In Charge (IIC):** | Scott, Arnold |
| **Additional Participating Persons:** | Randy M Holder; FAA FSDO; Denver, CO |
| **Original Publish Date:** | February 20, 2002 |
| **Last Revision Date:** | |
| **Investigation Class:** | Class |
| **Note:** | |
| **Investigation Docket:** | https://data.ntsb.gov/Docket?ProjectID=53314 |