Aviation Investigation Final Report

Location:	Saulsville, West Virginia	**Accident Number:**	IAD05LA122
Date & Time:	August 12, 2005, 13:30 Local	**Registration:**	N5691B
Aircraft:	Enstrom 280C	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	1 Serious, 1 None
Flight Conducted Under:	Part 91: General aviation		

Analysis

While on approach to the landing area, the pilot could not see a windsock, and based his estimation of the wind by watching leaves on the trees. As he approached the landing area at a "normal to steep angle," and while stabilized at approximately 40 knots indicated airspeed, about 100 feet above the ground, the helicopter began a slow, un-commanded yaw to the right. The pilot responded by applying left anti-torque pedal; however, the helicopter continued to yaw to the right. The pilot observed that the engine and rotor rpm were "out of the green," but felt that he could not enter an autorotation due to a power line that was below. He instead increased the throttle, and the helicopter continued to yaw to the right. About 10 feet above the ground, and after about 270 degrees of yaw, the helicopter descended rapidly and impacted the ground, seriously injuring the passenger. Examination of the helicopter following the accident revealed that the tail rotor had sustained impact damage to both blades, and that the tail rotor drive shaft was fractured at the coupling hub. Examination of the fractured portions of the coupling hub revealed signatures consistent with a torsional event, such as a tail rotor strike, and no evidence that the fracture surfaces were rubbing against each other under power. According to Federal Aviation Administration Advisory Circular 90-95, loss of tail rotor effectiveness (LTE) events typically occur in a low airspeed flight regime while maneuvering, such as on final approach to landing. Any maneuver that requires the pilot to operate at high-power, at low airspeed, and with a left crosswind or tailwind, creates an environment where unanticipated right yaw may occur. Additional factors that can influence the severity of the onset of LTE include increases in gross weight and density altitude, low indicated airspeeds, and power droop. Recovery from an LTE event should include the application of full left pedal, while simultaneously moving the cyclic forward to increase speed, and altitude permitting, a reduction in power.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's inadequate remedial action following a loss of control during the landing approach.

Findings

Occurrence #1: LOSS OF CONTROL - IN FLIGHT
Phase of Operation: APPROACH - VFR PATTERN - FINAL APPROACH

Findings
1. TAIL ROTOR EFFECTIVENESS - REDUCED
2. (C) REMEDIAL ACTION - INADEQUATE - PILOT IN COMMAND

Occurrence #2: FORCED LANDING
Phase of Operation: EMERGENCY DESCENT/LANDING

Occurrence #3: HARD LANDING
Phase of Operation: EMERGENCY DESCENT/LANDING

Factual Information

On August 12, 2005, about 1330 eastern daylight time, an Enstrom 280C, N5691B, received substantial damage when it impacted terrain near Saulsville, West Virginia. The certificated commercial pilot was not injured, and the passenger received serious injuries. Visual meteorological conditions prevailed, and no flight plan was filed for the business flight, which originated at Logan County Airport (6L4), Logan, West Virginia, about 1300, and was conducted under 14 CFR Part 91.

According to the pilot, the purpose of the flight was to drop off a package at a local community college. While on approach to the landing area, the pilot did not see a windsock, and based his estimation of the wind direction by watching leaves on the trees.

During the final approach, he adjusted the flight controls to decelerate and maintain the approach angle to the touchdown point, while maintaining the rotor rpm at 2,900. The helicopter approached the intended landing area at a "normal to steep angle."

Without any further control inputs, and while stabilized at approximately 40 knots indicated airspeed, about 100 feet above the ground, the helicopter began a slow, un-commanded yaw to the right. The pilot responded by applying left anti-torque pedal; however, the helicopter continued to yaw to the right.

As the helicopter turned beyond about 90 degrees from the original flight path, the pilot realized that he would not be able to land the helicopter in the intended landing area. He then checked the rotor and engine rpm and noted that they were "out of the green and decreasing." The pilot felt that he could not enter an autorotation due to a power line that was below, and instead increased the throttle to stabilize rotor rpm and maintain altitude in order to fly to a more suitable area for landing. The helicopter "did not respond," and continued yawing to the right. About 10 feet above the ground, and after about 270 degrees of yaw from the original direction of flight, the helicopter descended rapidly and impacted the ground.

The pilot held a commercial pilot certificate with a rating for rotorcraft-helicopter and a flight instructor certificate with a rating for rotorcraft-helicopter. He reported 297 total hours of flight experience, 15 hours of which were in the accident helicopter make and model.

The helicopter was examined following the accident. The left skid was broken, and the tail rotor sustained damage to both blades consistent with impact. Additionally, the tail rotor drive shaft was fractured at the coupling hub. The coupling hub, flex pack, coupling flange, drive shaft, and associated components were forwarded to the Safety Board Materials Laboratory for further examination.

Examination of the fractured portions of the coupling hub revealed that the fracture regions on both sides of the taper pin hole displayed light circumferential smearing and distinct circumferential surface lines that were consistent with torsional overload. There was no discoloration or severe mechanical damage observed on the fracture faces to indicate that the mating fracture faces had rubbed together while the system was transmitting power. Displaced material, oriented counter to the direction of rotation, was found on the sides of the exposed taper pin hole, consistent with a torsional event.

The weather reported at Raleigh County Memorial Airport (BKW), Beckley, West Virginia, about 17 nautical miles east, at 1351, included calm winds, scattered clouds at 4,400 feet, 4 statute miles visibility in haze, temperature 82 degrees Fahrenheit, dewpoint 64 degrees Fahrenheit, and an altimeter setting of 30.10 inches of mercury.

The elevation in the area of the accident site was about 2,000 feet, and the density altitude was calculated to be about 3,900 feet around the time of the accident.

According to the Enstrom 280C Flight Manual, steep approach procedures are used to clear obstacles in the flight path when landing in a confined area, and require precision power control. The airspeed of a steep approach should be between 30 and 35 mph, and the rate of descent should be as low as possible for the desired angle of descent. A relatively high amount of power is required to control the rate of descent.

According to Federal Aviation Administration Advisory Circular (AC) 90-95, Unanticipated Right Yaw in Helicopters, loss of tail rotor effectiveness (LTE) events typically occur in a low airspeed flight regime while maneuvering, on final approach to landing, or during low-level flying. Any maneuver that requires the pilot to operate at high-power, at low airspeed, and with a left crosswind or tailwind, creates an environment where unanticipated right yaw may occur. Additional factors that can influence the severity of the onset of LTE include increases in gross weight and density altitude, low indicated airspeeds, and "power droop," or a decrease in rotor rpm that causes a corresponding decrease in tail rotor thrust.

The AC also provided guidance regarding recovery techniques following an LTE event. If a sudden unanticipated right yaw occurs, the pilot should apply full left pedal, while simultaneously moving the cyclic forward to increase speed, and altitude permitting, reduce power. Following the recovery, the controls should be adjusted for normal forward flight. A collective pitch reduction will aid in arresting the yaw rate, but may cause an increase in the rate of descent. Any large, rapid increase in collective pitch to prevent ground or obstacle contact may further increase the yaw rate, and decrease rotor rpm.

Pilot Information

Certificate:	Commercial	**Age:**	45,Male
Airplane Rating(s):	None	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	Instrument helicopter	**Toxicology Performed:**	No
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	March 1, 2005
Occupational Pilot:	UNK	**Last Flight Review or Equivalent:**	June 1, 2005
Flight Time:	297 hours (Total, all aircraft), 15 hours (Total, this make and model), 218 hours (Pilot In Command, all aircraft), 38 hours (Last 90 days, all aircraft), 22 hours (Last 30 days, all aircraft), 3 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Enstrom	**Registration:**	N5691B
Model/Series:	280C	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	1180
Landing Gear Type:	Skid	**Seats:**	
Date/Type of Last Inspection:	December 1, 2004 Annual	**Certified Max Gross Wt.:**	2350 lbs
Time Since Last Inspection:	49 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:		**Engine Manufacturer:**	Avco Lycoming
ELT:	Installed, not activated	**Engine Model/Series:**	HIO-360
Registered Owner:	Marpat Aviation	**Rated Power:**	205 Horsepower
Operator:		**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	BKW,2504 ft msl	**Distance from Accident Site:**	17 Nautical Miles
Observation Time:	13:51 Local	**Direction from Accident Site:**	60°
Lowest Cloud Condition:	Clear	**Visibility**	4 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.1 inches Hg	**Temperature/Dew Point:**	28°C / 17°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Logan, WV (6L4)	**Type of Flight Plan Filed:**	None
Destination:	Saulsville, WV (NONE)	**Type of Clearance:**	None
Departure Time:	13:00 Local	**Type of Airspace:**	

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Serious	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Serious, 1 None	**Latitude, Longitude:**	37.652221,-81.449996

Administrative Information

Investigator In Charge (IIC):	Muzio, David
Additional Participating Persons:	Jerry Morgan; FAA/FSDO; Charleston, WV
Original Publish Date:	July 31, 2006
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=62274