Aviation Investigation Final Report

Location:	Abilene, Texas	**Accident Number:**	CEN13LA099
Date & Time:	December 7, 2012, 15:45 Local	**Registration:**	N574H
Aircraft:	Enstrom F-28C	**Aircraft Damage:**	Substantial
Defining Event:	Loss of engine power (total)	**Injuries:**	2 None
Flight Conducted Under:	Part 91: General aviation - Instructional		

Analysis

A student pilot and flight instructor departed with full fuel tanks on a round-robin cross-country flight in the student pilot's helicopter. The first three legs were uneventful with landings at all three locations. The flight instructor and the student pilot did not visually check the fuel tanks at stops during the flight. On the last leg, the instructor noted the fuel gauges and made the decision to continue to the destination. The student pilot told the flight instructor that the fuel quantity on board the helicopter was low. The flight instructor informed him that the fuel gauges were often faulty and that they had enough fuel to complete the return leg of the flight. About 2 miles from the destination, the helicopter yawed left twice, and the engine and rotor rpm began to decay. The instructor lowered the collective and leveled the helicopter. The rotor rpm decayed even further, to the point that it was below the minimum for autorotative descent. The instructor pushed the nose over then brought the helicopter back to a level attitude. He reported that this caused the blades to cone upward and increased the rotor rpm, but the rpm was still below the red line. The instructor nosed the helicopter over again and turned left but was unable to regain rotor speed. The instructor was certain that, in addition to the loss of engine power, the overrunning clutch had not disengaged the engine from the transmission. The instructor leveled the helicopter about 3 feet above the ground and applied collective but reported that only about one-third of normal rotor rpm was available. The helicopter landed hard and the main rotor blades impacted the tailboom. A postaccident examination revealed that the fuel tanks contained no usable fuel, and, when serviced with fuel, the engine was operational. An examination of the overrunning clutch operation revealed no anomalies.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The flight instructor's failure to conduct an autorotation following the loss of engine power due

to fuel exhaustion. Contributing to the accident was the failure of the flight instructor and the student pilot to visually check fuel levels to ensure adequate fuel on board for the planned flight.

Findings

Personnel issues	Aircraft control - Pilot
Aircraft	Fuel - Fluid level
Personnel issues	Incorrect action performance - Pilot
Aircraft	Fuel - Inadequate inspection

Factual Information

History of Flight

Prior to flight	Preflight or dispatch event
Approach	Loss of engine power (total) (Defining event)
Autorotation	Hard landing

On December 7, 2012, about 1545 central standard time, an Enstrom F-28C helicopter, N574H, impacted terrain during an autorotation following a loss of engine power during approach to the Abilene Regional Airport (ABI), near Abilene, Texas. The certified flight instructor and student pilot reported no injuries. The helicopter sustained substantial tailboom damage. The helicopter was registered to and operated by the student pilot under the provisions of 14 Code of Federal Regulations Part 91 as an instructional flight. Visual flight rules (VFR) conditions prevailed for the flight, which did not operate on a VFR flight plan. The flight originated from the Brownwood Regional Airport (BWD), near Brownwood, Texas, at time unknown and was destined for ABI.

According to the flight instructor's accident report, the instructor and student pilot arrived at 0930 outside a fixed base operator at the ABI. They discussed subjects including his helicopter; N574H, helicopter logbooks, maintenance history, helicopter airworthy condition, preflight actions, the student pilot's aviation experience, and various other topics for about an hour. There were no pending maintenance issues detected and after an extensive preflight inspection, the instructor found the helicopter to be in an airworthy condition. The instructor indicated that the fuel tanks were completely filled, which would have given them "40 gallons of total fuel." The student requested that they fly to Albany, Eastland, Brownwood then return to Abilene. The first three legs were uneventful with landings at all three locations. On the last leg, he noted the fuel level and made the decision to continue to ABI. The fuel gauge read 3/8ths full. The instructor estimated that out of 40 gallons total fuel, the helicopter passed over BWD with 15 gallons of fuel. He further figured that with a fuel burn of 13.5 gallons per hour and 30 to 35 minutes to ABI, the helicopter should land with the required 20-minute reserve. Approximately four miles from ABI, the flight was cleared to pass behind a Beechcraft on final to 17L. At 2 miles from ABI, the helicopter yawed left briefly. The instructor stated that he turned his attention from the Beechcraft to the engine instruments and to what the student pilot was doing. The helicopter yawed to the left one more time and the engine and rotor RPM began to decay. The instructor lowered the collective, let the student pilot know that he was now flying the helicopter, and leveled the helicopter for a 70-knot attitude. This made the rotor RPM decay even further, where it was now under the minimum for autorotative descent. The instructor pushed the nose over then back to nose level. He reported this caused the blades to cone upward and increase rotor RPM, but it was still below the red line. The instructor nosed the helicopter over again and turned left. This caused the rotor to cone upward and "unload". He said that this maneuver should have regained "rotor speed to the high side but was only

slightly effective." The instructor, in part, reported:

> It was now fairly certain to me that I was not only having an engine failure, but also the over running clutch had not disengaged the engine from the transmission. I was now facing to the South and rotor RPM at the red line once again. I flared the helicopter at 30 feet AGL [above ground level]. This slowed the helicopter down but now the rotor system was "loaded" and being dragged down to 200 RPM. At 3 feet I leveled the helicopter and applied collective to cushion the landing but I had only about 1/3rd of the rotor RPM normally available. The helicopter landed level with very little forward movement. One of the main rotor blades contacted the tailboom causing the helicopter to spin to the left approximately 60 degrees. The next rotor blade contacted to tailrotor debris. The third main rotor blade had only the damage caused by the sudden stoppage.

According to the student pilot's accident report, the student pilot voiced his opinion on the low fuel quantity on board the helicopter. He said that the flight instructor informed him the fuel gauges are often faulty and that they had enough fuel to complete the return leg of the flight to ABI.

Federal Aviation Administration inspectors oversaw a postaccident examination of the helicopter. A mechanic assisted the inspector's examination where less than one gallon of fuel was drained from each of the right and left hand fuel tank sumps. The fuel strainer and fuel injection servo screen were examined and reinstalled. The helicopter was serviced with four gallons of 100 low lead aviation gasoline. The engine subsequently started and ran smoothly for five minutes. An inspector examined the over running clutch operation and no anomalies were detected.

The Enstrom rotorcraft flight manual (FM) for the F-28C helicopter preflight inspection checklist indicated that the right hand and left hand fuel tanks are to be visually checked in reference to their quantity and confirm both fuel tank caps are secured. The checklist further indicated to drain both the right hand and left hand tank sumps. The FM, in part, stated:

> ROTOR - FLIGHT LIMITATIONS (POWER OFF)
> Maximum: ..... 385 rpm
> Minimum ..... 332 rpm
>
> ...
>
> ENGINE WARMUP AND GROUND CHECK...
> 4. Gently close throttle to split tachometer needles to check proper operation of over running clutch.

...

ENGINE FAILURE
1. Enter normal autorotation and stabilize at 58 MPH (minimum rate of [descent]). (See Height Velocity information, pages FM-5-4 and FM-5-5.)
NOTE: Due to high rates of descent at forward speeds, sustained auto rotation speed is limited to 85 MPH to 8200 ft. Above 8200 ft., see FM-5-1.
Maximum glide distance in autorotation is attained at 80 mph and 332 rotor rpm. (Reduce collective to build RPM prior to touchdown.)

At 1452, the recorded weather at ABI indicated that the wind was calm.

Enstrom Service Directive Bulletin No. 0092, Fuel Quantity System Calibration, indicated that one gallon per fuel tank was unusable fuel and in part, stated:

> Pilots can assist in determining if the fuel quantity system is operating correctly by monitoring the fuel quantity indication prior to and after refueling and comparing the indications to the total quantity of fuel used in servicing the tanks. In addition, a fuel dipstick, [part number] 28-12478-11 for all 20 gallon (40 gallon total capacity) tanks, should be used during preflight inspection to verify fuel quantity on all aircraft so equipped.

Neither the flight instructor nor the student pilot visually checked the fuel level in the fuel tanks at any of the stops during the round robin cross-country flight.

Flight instructor Information

Certificate:	Commercial; Flight instructor	**Age:**	50,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	Helicopter	**Second Pilot Present:**	Yes
Instructor Rating(s):	Helicopter; Instrument helicopter	**Toxicology Performed:**	No
Medical Certification:	Class 1 With waivers/limitations	**Last FAA Medical Exam:**	
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	May 15, 2012
Flight Time:	6800 hours (Total, all aircraft), 2000 hours (Total, this make and model), 100 hours (Last 90 days, all aircraft), 20 hours (Last 30 days, all aircraft)		

Student pilot Information

Certificate:	Private; Student	**Age:**	41,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 3 Without waivers/limitations	**Last FAA Medical Exam:**	April 19, 2012
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	1500 hours (Total, all aircraft), 70 hours (Last 90 days, all aircraft), 20 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Enstrom	**Registration:**	N574H
Model/Series:	F-28C	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	361
Landing Gear Type:	Skid	**Seats:**	3
Date/Type of Last Inspection:	February 17, 2012 Annual	**Certified Max Gross Wt.:**	2350 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	1148 Hrs	**Engine Manufacturer:**	LYCOMING
ELT:	Not installed	**Engine Model/Series:**	HIO-360-E1AD
Registered Owner:	Pilot	**Rated Power:**	205 Horsepower
Operator:	Pilot	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	ABI,1790 ft msl	**Distance from Accident Site:**	2 Nautical Miles
Observation Time:	14:52 Local	**Direction from Accident Site:**	270°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.81 inches Hg	**Temperature/Dew Point:**	18°C / 3°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Brownwood, TX (BWD)	**Type of Flight Plan Filed:**	None
Destination:	Abilene, TX (ABI)	**Type of Clearance:**	VFR
Departure Time:	15:00 Local	**Type of Airspace:**	

Airport Information

Airport:	Abilene Regional Airport ABI	**Runway Surface Type:**	
Airport Elevation:	1790 ft msl	**Runway Surface Condition:**	
Runway Used:		**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

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:**	32.411388,-99.681945(est)

Administrative Information

Investigator In Charge (IIC):	Malinowski, Edward
Additional Participating Persons:	William J Fitzgerald; Federal Aviation Administration; Lubbock, TX Douglas Smith; Enstrom Helicopter Corporation; Menominee, MI
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Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=85796