National Transportation Safety Board
Aviation Accident Final Report

Location:	Howe, TX	**Accident Number:**	CEN16FA315
Date & Time:	08/09/2016, 2035 CDT	**Registration:**	N9277R
Aircraft:	HUGHES 269C	**Aircraft Damage:**	Substantial
Defining Event:	Loss of control in flight	**Injuries:**	1 Fatal, 1 Serious
Flight Conducted Under:	Part 91: General Aviation - Instructional		

Analysis

The flight instructor and student pilot were flying the helicopter near dusk about 1,100 ft above ground level (agl) when the instructor initiated a practice autorotation, by reducing the throttle to idle. The engine subsequently experienced a total loss of power; the instructor attempted to restart the engine, but, was unsuccessful. The student provided conflicting statements regarding who was controlling the helicopter during the autorotation and landing, but stated that he started the landing flare about 25 ft agl. He further stated that he did not think that the helicopter's descent had been sufficiently slowed before the helicopter impacted the ground. Upon impact, the tail boom partially separated and the helicopter rolled over, coming to rest on its right side.

Postaccident examination of the helicopter and engine did not reveal any mechanical malfunctions or anomalies that would have precluded normal operation. Impact damage precluded any functional testing of the engine and its components, and the reason for the reported loss of engine power could not be determined.

The pilot's flight manual stated that an engine restart should not be attempted below 2,000 ft agl, and that, below that altitude, the pilot should conduct a normal autorotation to landing. The manual also stated that the fuel boost pump should be activated before a practice autorotation. The fuel boost pump switch was found in the OFF position. The manual also states that rapid throttle reductions to full idle during flight shall not be conducted at any altitude to minimize the possibility of engine stoppage.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

The improper execution of an autorotation following the loss of engine power, which resulted in an uncontrolled descent into terrain. Contributing to the accident was the flight instructor's lack of remedial action during the autorotation.

Findings

Aircraft	Engine (reciprocating) - Simulated malf/failure
Personnel issues	Aircraft control - Instructor/check pilot (Cause)
	Aircraft control - Student pilot (Cause)
	Incorrect action performance - Instructor/check pilot (Cause)
	Lack of action - Instructor/check pilot (Factor)

Factual Information

History of Flight

Maneuvering	Loss of engine power (total)
Autorotation	Loss of control in flight (Defining event)
	Collision with terr/obj (non-CFIT)

On August 9, 2016, at 2035 central daylight time, a Hughes 269C helicopter, N9277R, impacted terrain following an autorotation near Howe, Texas. The flight instructor was fatally injured, the student pilot sustained serious injuries, and the helicopter sustained substantial damage. The helicopter was privately owned and operated under the provisions of 14 *Code of Federal Regulations* Part 91. Visual meteorological conditions prevailed at the time of the accident, and no flight plan was filed. The local instructional flight departed the Sherman Municipal Airport (SWI), Sherman, Texas, at an unknown time.

The student pilot reported to a law enforcement officer who responded to the accident that he and the flight instructor were flying about 1,100 ft above ground level (agl) when the instructor initiated a practice autorotation which included reducing the throttle to idle to simulate an engine failure. When the engine power was reduced, the engine experienced a total loss of power. The flight instructor attempted to restart the engine, but was unsuccessful. The student stated that the autorotation was initially controlled, but then the helicopter impacted terrain in a high-speed descent. During the impact, the tail boom partially separated, and the helicopter rolled over, coming to rest on its right side.

In a written statement, the student reported that he and the instructor had completed some landings and other operations at SWI, and were returning to his residence at an altitude about 1,200 ft agl. While en route, the instructor "slowly rolled down the throttle to simulate [an] engine failure." After noticing the throttle reduction, the student lowered the collective and looked for an appropriate place to land. The student and instructor then noticed the engine rpm gauge was reading zero. The student stated that both he and the instructor were "on the controls" during the autorotation. The student recalled starting to flare about 25 ft agl, and did not recall any details after the flare. The student reported, "I feel we didn't slow the descent enough before contacting the ground..." The student exited the helicopter and attempted, unsuccessfully, to extricate the instructor. He then went to search for assistance.

According to a Federal Aviation Administration (FAA) inspector, who spoke with the student after the accident, the student stated that the instructor never touched or manipulated the flight controls during the flight and during the accident sequence.

Flight Instructor Information

Certificate:	Flight Instructor; Commercial	**Age:**	58, Male
Airplane Rating(s):	Single-engine Land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	4-point
Instrument Rating(s):	Helicopter	**Second Pilot Present:**	Yes
Instructor Rating(s):	Helicopter; Instrument Helicopter	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 With Waivers/Limitations	**Last FAA Medical Exam:**	09/11/2014
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	2211 hours (Total, all aircraft), 25 hours (Total, this make and model)		

Student Pilot Information

Certificate:	Student	**Age:**	43, Male
Airplane Rating(s):	None	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	4-point
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:**	09/14/2015
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	63.7 hours (Total, all aircraft), 63.7 hours (Total, this make and model)		

According to the FAA inspector who spoke with the student, the student had accumulated 25 flight hours with a local helicopter flight school before flying with the accident instructor. He'd stopped flying with the local flight school in October 2012. Since October 2015, the student had flown several flights with the instructor and had accumulated 63.7 total flight hours at the time of the accident.

According to law enforcement, on July 12, 2014, the student had been involved in a previous accident in the same make/model helicopter. The student stated to the FAA inspector that he was moving the helicopter when the helicopter "got away from him." The accident was not reported to the NTSB.

Aircraft and Owner/Operator Information

Aircraft Make:	HUGHES	**Registration:**	N9277R
Model/Series:	269C	**Aircraft Category:**	Helicopter
Year of Manufacture:	1979	**Amateur Built:**	No
Airworthiness Certificate:	Normal	**Serial Number:**	790809
Landing Gear Type:	Skid	**Seats:**	2
Date/Type of Last Inspection:	08/10/2015, Annual	**Certified Max Gross Wt.:**	1847 lbs
Time Since Last Inspection:	39 Hours	**Engines:**	1 Reciprocating
Airframe Total Time:	5663 Hours at time of accident	**Engine Manufacturer:**	Lycoming
ELT:	Not installed	**Engine Model/Series:**	HIO-360-D1A
Registered Owner:	Matt Cavender	**Rated Power:**	180 hp
Operator:	On file	**Operating Certificate(s) Held:**	None

The helicopter's most recent annual inspection (which included an annual, 100, 200, 400 and 24-month inspections) was completed on August 10, 2015, at a total airframe time of 5,624 hours and a Hobbs meter time of 13.0 hours. At the time of the inspection, the engine had accumulated 3,664.6 total hours and 392.6 hours since overhaul. The Hobbs meter time at the accident site was 52.7 hours.

Review of maintenance records revealed no entries or comments related to idle/mixture adjustments or settings.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	**Condition of Light:**	Dusk
Observation Facility, Elevation:	GYI	**Distance from Accident Site:**	
Observation Time:	2035 CDT	**Direction from Accident Site:**	
Lowest Cloud Condition:	Clear	**Visibility**	10 Miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	5 knots /	**Turbulence Type Forecast/Actual:**	/ None
Wind Direction:	130°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.9 inches Hg	**Temperature/Dew Point:**	34°C / 18°C
Precipitation and Obscuration:	No Precipitation		
Departure Point:	Howe, TX	**Type of Flight Plan Filed:**	None
Destination:	Howe, TX	**Type of Clearance:**	None
Departure Time:	CDT	**Type of Airspace:**	Class G

Review of sun and moon data from the U.S. Naval Observatory revealed that, on the day of the accident, sunrise was at 0644, sunset was 2018, and the end of civil twilight was 2045.

Wreckage and Impact Information

Crew Injuries:	1 Fatal, 1 Serious	**Aircraft Damage:**	Substantial
Passenger Injuries:	N/A	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal, 1 Serious	**Latitude, Longitude:**	33.567500, -96.577500

The helicopter impacted down sloping grassy terrain adjacent to wooded areas and residential structures. The main wreckage consisted of the fuselage, a portion of the tail boom, and the main rotor system. The landing gear skids were spread apart and bent up into the fuselage. The instrument panel was partially separated from the fuselage. The fuel boost pump switch was found in the OFF position. The right seat anti-torque pedals were separated from the pedal supports. Both the left and right seat bottom panels were crushed downward about 4 inches. Flight control continuity was established from the cockpit to all flight controls in the main rotor and tail rotor systems. The three main rotor blades were bent and deformed, and remained attached to the rotor head.

Upon their arrival to the accident site, first responders noted that fuel was draining from the fuel tanks.

The helicopter was recovered to a secure storage facility for further examination.

On August 30, 2016, the helicopter was examined by the NTSB investigator-in-charge, a representative from the FAA rotorcraft directorate, representatives from Sikorsky Aircraft, and a representative from Lycoming Engines.

Examination of the airframe revealed the mast was intact and three support struts were straight and attached. The transmission was intact and remained attached to the steel center frame. The steel tube support frame exhibited bending, buckling, and fractures. The two forward cockpit floor support struts were fractured. The cockpit floor was separated from the base of the seat deck. The door frames were fractured and separated. The aft cabin wall was distorted and wrinkled at bottom attach area to the seat deck. The canopy frame was fractured and separated with all Plexiglas broken and separated.

The main rotor blades remained attached to the rotor head, and the blades were intact. The yellow blade was bent up at the root end doubler, bowed down at mid-span, and upward at the blade tip. Chordwise crushing and trailing edge wrinkles were noted about mid-span. White paint transfer, consistent with contact with the airframe, was noted on the bottom leading edge. The blue blade was bent downward at the root end doubler, bowed upward near mid-span, and downward at the tip. White paint transfer was present near the blade tip. The red blade was bent downward at the root end doubler. The blade was relatively straight.

The main rotor head was intact and attached to the drive shaft. The rotor head turned freely in the mast bearing with continuity through the main gear box. The three upper main rotor hub attach bolts exhibited compression damage. The compression damage was consistent with contact from the pitch bearing shaft from a high upward blade movement. The blade up-flapping/coning was consistent with blade to ground contact. The droop stop ring was not present.

The tail boom was fractured at the center bulkhead rivet line, and the forward section was separated from the steel tube frame and strut at the forward bulkhead. Both tail boom support struts were fractured at the lower tabs in a downward direction. A main rotor blade contact dent was noted aft of the center attach fitting, at the internal damper location. The left support strut remained attached to the tail boom and exhibited a long black mark on the outside lower portion of the tube, consistent with main rotor blade contact. The horizontal stabilizer displayed downward bending damage and skin buckling at the forward attachment to the tail boom. The lower vertical stabilizer sustained crush damage consistent with ground contact.

The tail rotor blades remained attached to the hub. Both blades displayed minor airfoil damage. One blade was intact and straight, and one blade was fractured at the end of the hub. The tail rotor driveshaft was separated at the forward end from the main gear box pinion drive spline. The driveshaft remained in one piece, but was buckled and folded aft at the boom separation point. The driveshaft exhibited torsional twisting near the forward end with twisting in the direction of rotation, consistent with tail rotor contact prior to separation.

The left landing gear skid remained attached to the forward cross beam at the strut and

damper. The left aft skid was separated at the strut to cross beam, with the fracture consistent with overload failure. The right landing gear skid forward strut remained attached to the crossbeam, and the aft strut separated at the crossbeam. The skid was bent between the forward and aft strut attach points, and fractured forward of the forward strut.

The engine remained partially attached to the airframe. The exhaust pipes were crushed, deformed, and displaced, consistent with ground contact. The fuel injector body exhibited impact marks consistent with forward landing gear crossbeam contact. The throttle bellcrank linkage was fractured and separated from the bottom of inlet adapter mount.

Engine control continuity was established from the cockpit controls to the engine components; however, full motion was restricted due to airframe deformation. Thumb compression and valve motion was noted on all cylinders. The magnetos were removed and rotated with a portable drill, and all eight spark plug leads produced spark. The fuel injector nozzles were removed and all nozzles exhibited some carbon on the orifice tips. The fuel injector body bore exhibited carbon deposits. The drained oil from the crankcase was black in color. The engine could not be functionally tested due to damage.

Blue fuel stains were noted from the filler caps on both the main (left) and auxiliary (right) fuel tanks. A puncture was noted in the bottom of the auxiliary tank, and no fuel was present in the fuel tanks. Fuel was found in the fuel injector and fuel pump.

Medical And Pathological Information

The instructor died in the hospital on August 10, 2016.

The Dallas County Office of the Medical Examiner, Dallas, Texas, performed an autopsy on the instructor. The autopsy report stated that the cause of death was blunt force injuries.

The FAA's Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma, performed forensic toxicology on specimens from the flight instructor. The results were negative for carbon monoxide and ethanol. Testing identified Acetaminophen (31.2 (ug/ml) in the urine, glucose (160 mg/dl) in vitreous, glucose (18 mg/dl) in urine, and the blood sample was unsuitable for analysis of Hemoglobin A1C.

Acetaminophen is a pain and fever reliever commonly sold under the trade name Tylenol.

Additional Information

The Pilot's Flight Manual found at the accident site was last updated in June 2000. According to the manufacturer, there had been nine revisions since that date, with the latest revision

November 19, 2014. A complete re-issue was published December 7, 2012, which included new warnings on practice autorotations and throttle management.

According to the Pilot's Flight Manual (revised July 5, 1996) that was located at the accident site, Emergency Procedures, page 3-1, Section 3-1 Engine Failure – Altitude Above 450 Feet, stated in part:

"Lower collective pitch. Enter normal autorotation.

Establish a steady glide of 52 knots (60 mph) IAS approximately.

At an altitude of 50 feet, begin steadily to apply back cyclic stick to decreased forward airspeed.

At approximately 10 feet, coordinate collective pitch with forward movement of cyclic stick to level ship and cushion landing. Make ground contact with ship level."

The Pilot's Flight Manual (revised July 5, 1996) Emergency Procedures, page 3-7, Section 3-11 Air Restart stated in part:

"Pick out landing spot. If less than 2000 feet above terrain, proceed with autorotation landing. Pull mixture control to IDLE CUTOFF when time permits to stop flow of fuel from nozzles."

The Pilot's Flight Manual (revised June 15, 1994) Normal Procedures pages, 4-20 to 4-22, Pilot's Check of Idle Mixture, Idle Speed, and Fuel Boost Pump, stated in part:

"NOTE: This check of idle mixture, idle speed, and fuel boost pump shall be accomplished at the end of the last flight each day, prior to engine shutdown.

Accomplish the engine idle mixture check as follows:

Land from a hover with engine cylinder head temperature and oil temperature as near to in-flight conditions as possible, friction on the collective and cyclic controls, governor disengaged, and engine speed at operational rpm.

Ensure MIXTURE is set to FULL RICH.

Rapidly rotate throttle to CLOSED position. (Set at normal idle stop, do not override.)

NOTE: Engine speed with immediately decrease to idle level. Rotor speed, however, will decline gradually. The next step must be performed before rotor tachometer needle superimposes with engine tachometer needle.

Observe engine tachometer need and smoothly move mixture control toward IDLE CUTOFF position.

Return mixture control to FULL RICH before the rpm decreases to a point where the engine will stop.

NOTE: Engine rpm rise is required to be between 25 and 100 rpm for this check.

If rpm rise is not within the required limits, notify the appropriate maintenance personnel to perform proper idle speed and mixture adjustments.

Accomplish an idle speed check as follows:

Operate helicopter at operational rpm with rotor system engaged, friction on the collective and cyclic controls, and governor disengaged.

Rapidly rotate throttle closed and into full override position.

Read and record engine idle rpm to engine and rotor tachometer needles superimposing.

With engine head temperature near 300 degrees F, but not above, repeat the three preceding steps, without going into full override (set throttle at normal idle stop).

NOTE: The first check (throttle into full override) should produce an idle speed no less than 1400 rpm. The second check (throttle at normal idle stop) should produce an idle speed no greater than 1600 rpm.

If engine idle speed is not within the required limits, notify the appropriate maintenance personnel to perform adjustments in accordance with the Basic HMI."

The November 2014 revision of the Pilot's Flight Manual Normal and Emergency Procedures sections included the following warnings and instructions:

"Engine idle speeds at high density altitude may be less than those set at sea level conditions. Do not rapidly reduce throttle to idle stop in flight.

WARNING – To minimize possibility of engine stoppage, rapid throttle reductions to full idle during flight shall not be conducted at any altitude."

"WARNING – During power recovery from practice autorotations, airspeed and altitude combinations that are inside the height velocity curve shall be avoided. High rates of descent may develop from which recovery may be difficult or not possible.

WARNING – Practice autorotations shall be conducted in an area with a suitable landing site available to minimize hazards associated with inadvertent engine stoppage.

WARNING – To reduce the chance of engine stoppage when initiating practice autorotations or simulated forced landing training the throttle shall not be abruptly retarded to the idle position.

CAUTION – At high power settings an overspeed might occur if throttle is not reduced slightly when collective is lowered.

Ensure fuel boost pump is activated prior to commencing autorotation training. Split the needles by reducing throttle slightly and lowering the collective. The throttle correlation will establish a high idle rpm (approximately 2500 rpm) which will aid in preventing the engine from loading up or stalling during recovery. Conversely, for recovery, increase throttle slightly

when the collective is raised, the correlation is such that only minor throttle adjustments will be required to perform a smooth recovery without exceeding 3200 rpm.

If engine stops make a touchdown auto landing."

Administrative Information

Investigator In Charge (IIC):	Aaron M Sauer	**Report Date:**	09/26/2017
Additional Participating Persons:	Gary Watson; Federal Aviation Administration; Dallas, TX Jill Browning; Sikorsky; Stratford, CT John Butler; Lycoming Engines; Williamsport, PA		
Publish Date:	09/26/2017		
Note:	The NTSB traveled to the scene of this accident.		
Investigation Docket:	http://dms.ntsb.gov/pubdms/search/dockList.cfm?mKey=93803		